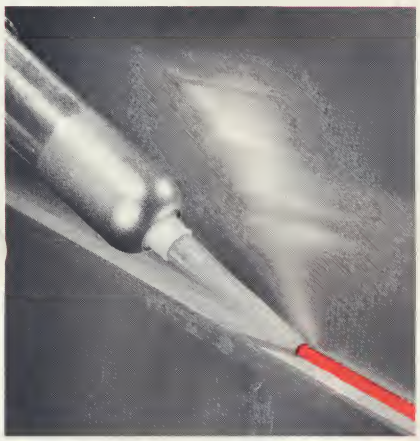
SILICONES

TECHNICAL DATA BOOK **S-2D**

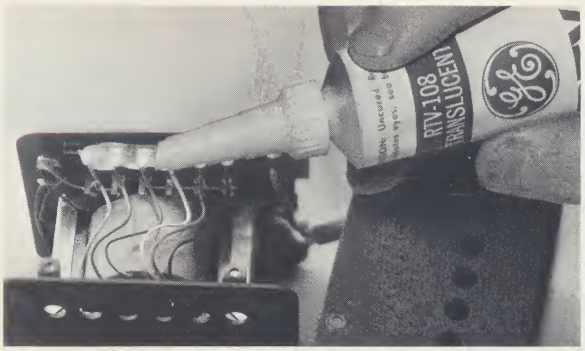
SILICONE RUBBER ADHESIVE/SEALANTS

for Industrial Applications

High-Temperature RTV-106

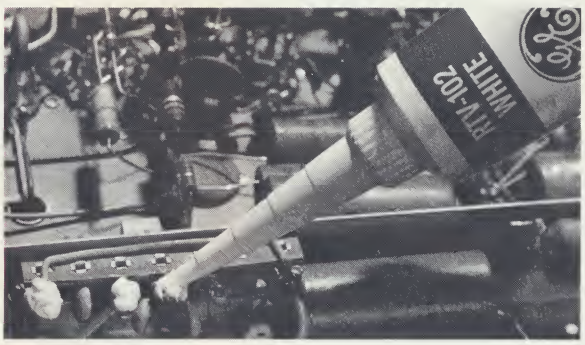


Black RTV-103



Translucent RTV-108

Aluminum RTV-109



White RTV-102

Pourable White RTV-112
Also: Pourable Red RTV-116
Pourable Translucent RTV-118

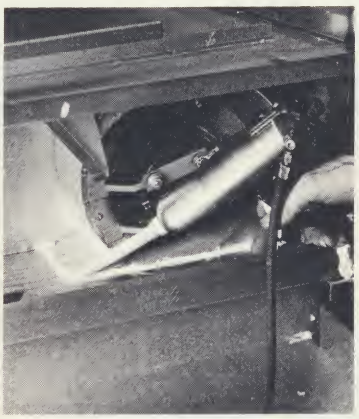
GENERAL ELECTRIC

SILICONE PRODUCTS DEPARTMENT
WATERFORD, NEW YORK • 12188

adhesive/sealants

INDUSTRIAL USES...

Applications unlimited for G-E Silicone adhesive/sealants to serve you.



1. RTV bonds vent units and ducts in new Hotpoint range, seals areas of metal-to-metal contact to prevent escape of cooking vapors. RTV is damping medium for vent motor, reducing sound and vibration.

2. RTV bonds sheeting into desired configuration in low volume production of cylindrical air ducts for dielectric heaters. Results: production costs cut more than 300%.

3. RTV seals filament condenser plates in dielectric heaters. Reasons: RTV resists high temperature, insulates electrically, locks out conductive contamination.

4. RTV fills gaps and hairline crevices in food processing equipment. Several RTV sealants have been FDA sanctioned when properly used.

5. RTV laminates layers of mica sheeting and plates in production of plate condensers. Results: improved operational reliability, assembly time cut from 24 hours to 20 minutes.

6. RTV eliminates need for screws and drilling when used to affix name plates and decorative emblems on any surface. Results: no unsightly rust drainage; plates stay put indefinitely, but can be cut loose when desired.

7. RTV joins the edges of two castings in a yard cleaning machine. The maker eliminated much machining for the surfaces need not be flush to each other. RTV also saved $4000 over alternate sealing methods.

8. RTV-108 provides instant, "see-through" insulation as well as vibration resistance and environmental protection. RTV needs no pre-mixing; is applied directly from the tube.

9. RTV-102 provides quick relief from low-pressure leaks. Silicone Rubber RTV's are waterproof and provide excellent protection during a wide temperature range.

10. RTV seals glass and plastic instrument lenses against dirt and moisture. RTV-102 is easily applied and will not sag.

11. RTV seals A-N connectors, terminals, and wire harness joints and other flexible parts. It will absorb shock and vibration eliminating the fatigue failure of connections.

12. RTV-106 can be used for gasket repair or gasket sealing where high temperatures would prohibit normal sealant use.

THIXOTROPIC RTV SILICONE RUBBER FOR . . .

general purpose industrial use

RTV-102	White
RTV-103	Black
RTV-108	Translucent
RTV-109	Aluminum

Because of many advantages including easy application and wide color selection, these four G-E adhesive/sealants are ideal for an unlimited number of industrial applications.

Consistency	Soft, spreadable thixotropic paste
Color	White, black, aluminum, translucent (see above)
Specific Gravity	1.07
Solids Content	Contains no solvent.
Non Volatiles % (24 hrs/158°F)	92% (min.)
Flow (Mil-S-8802B)	Nil (0.1 inch max.)
Tack Free Time (77°F, 50% R.H.)	30 minutes
Application Rate gm/min. (Semco Gun with #440 Nozzle 0.125 orifice) Gun Pressure 90 ± 2 psi	200–500

Physical Properties

(ASTM pressed sheets cured at 77°F and 50 percent R.H.)

Property	7-Day Cure
Hardness, Shore A	30
Tensile Strength, psi	350
Elongation, %	400
Tear Resistance, Die B, lb/in.	45
Linear Shrinkage, %	1.0
Specific Gravity	1.07

Heat Aging Data

(Typical data obtained on ASTM pressed sheets cured one week at 77 F and 50 percent R.H.)

Property	Time at Temperature (after one week cure)				
	1 wk/ 77°F	24 hr/ 300°F	1 wk/ 300°F	24 hr/ 350°F	24 hr/ 400°F
Hardness, Shore A	30	35	33	36	43
Tensile Strength, psi	350	385	450	425	250
Elongation, %	400	400	400	475	200

Electrical Properties

(ASTM pressed sheets cured 10 days at 77 F and 50 percent R.H. Specimens conditioned 24 hours at 75 F and 50 percent R.H. prior to electrical testing.)

Dielectric Strength, Volts/Mil	
Thickness .058"	550
Thickness .103"	425
Dielectric Constant	
60 Hz	2.8
10^3 Hz	2.7
10^6 Hz	2.6
Dissipation Factor	
60 Hz	0.0026
10^3 Hz	0.0026
10^6 Hz	0.0026
Volume Resistivity ohm-cm	3×10^{15}

Bonding

See general characteristics of RTV adhesive/sealants on page 7. Typical bond strength data available on test samples are as follows:

Substrate*	Adhesive Characteristics, Properties			
	Shear Strength†		Peel Strength‡	
	psi	% Cohesive Failure	lb/in.	% Cohesive Failure
Unprimed Alclad Aluminum 2024-T6 per QQ-A-362	200	95–100	20	90–95
Primed—SS-4004 Alclad Aluminum 2024-T6 per QQ-A-362	200	100	20	100

*20-mesh stainless steel bonded to substrate listed
†70 hour cure at 77°F and 50% R.H.
‡7 day cure at 77°F and 50% R.H.

Similar values of adhesive strength have been obtained on such materials as anodized and alodized aluminum, copper, titanium, glass, epoxy resin, polyimides, brass, silver, carbon steel, Lexan® polycarbonate resin, Textolite® electrical insulating material, and silicone rubber (both heat cured and RTV types).

RTV SILICONE RUBBER FOR . . .

high temperature industrial use

RTV-106	Red, Paste
RTV-116	Red, Pourable

RTV-106 and RTV-116 are recommended for extreme high temperature applications. These products are specially formulated and processed to perform at temperatures up to 600 F with relatively little change in physical properties.

Uncured Properties	**RTV-106**	**RTV-116**
Consistency	Soft, spreadable thixotropic paste	Pourable, like paint
Color	Red	Red
Specific Gravity	1.07	1.09
Solids Content	Contains no solvent	Contains no solvent
Non Volatiles % (24 Hrs/158°F)	96% (min.)	96% (min.)
Flow (Mil-S-8802B)	Nil (0.1 inch max.)	Self-leveling
Tack Free Time (77°F, 50% R. H.)	30 minutes	30 minutes
Application Rate gm/min. (Semco Gun with #440 Nozzle 0.125 orifice) Gun pressure 90 ± 2 psi	200-500	600

Physical Properties

(ASTM pressed sheets cured at 77 F and 50 percent R.H.)

Property	**2-Day Cure**	
	RTV-106	**RTV-116**
Hardness, Shore A	33	22
Tensile Strength, psi	350	425
Elongation, %	400	400
Tear Resistance	50 (Die B, lb/in.)	53 (Die C, lb/in.)
Linear Shrinkage %	<0.5	0.2
Specific Gravity	1.07	1.09

Electrical Properties for RTV-106 and RTV-116

(ASTM pressed sheets cured 10 days at 77 F and 50 percent R.H. Specimens conditioned 24 hours at 75 F and 50 percent R.H. prior to electrical testing.)

Dielectric Strength, Volts/Mil	
Thickness .058"	550
Thickness .103"	425
Dielectric Constant	
60 Hz	2.8
10^3 Hz	2.7
10^6 Hz	2.6
Dissipation Factor	
60 Hz	0.0026
10^3 Hz	0.0026
10^6 Hz	0.0026
Volume Resistivity ohm-cm	3×10^{15}

Heat Aging Data

(Typical data obtained on ASTM pressed sheets cured one week at 77 F and 50 percent R.H.)

Property	**Time at Temperature (after one week cure)**											
	48 hr/ 77°F		**24 hr/ 480°F**		**1 wk/ 480°F**		**24 hr/ 600°F**		**1 wk/ 600°F**		**2 wk/ 600°F**	
	RTV-106	**RTV-116**	**RTV-106**	**RTV-116**	**RTV-106**	**RTV-116**	**RTV-106**	**RTV-116**	**RTV-106**	**RTV-116**	**RTV-106**	**RTV-116**
Hardness, Shore A	33	24	28	12	28	14	30	13	45	26	65	38
Tensile Strength, psi	350	445	370	365	390	455	325	385	420	450	475	565
Elongation, %	400	350	550	500	540	490	500	450	300	320	180	300
Tear	50*	51†	47*	40†	43*	42†	43*	35†	40*	38†	40*	54†
Linear Shrinkage, %	<0.5	0.3	2.5	1.0	2.5	2.0	4.0	2.0	9.0	4.8	16.0	11.3
Weight Loss, %	...	...	4.7	3.8	5.2	5.5	11.9	9.7	23.4	21.6	40.6	32.4

* Die B, lb/in.
† Die C, lb/in.

Bonding

RTV-106 and RTV-116 High Temperature industrial adhesive/sealants are similar in bonding properties to General Purpose Industrial (Thixotropic) type. For bond strengths see the bonding section of that product or the general bonding characteristics on page 7.

POURABLE RTV SILICONE RUBBER FOR . . .

general purpose industrial use

RTV-112	White
*RTV-116	Red
RTV-118	Translucent

*Data for RTV-116 pourable RTV Silicone Rubber appear on Pg. 7

RTV-112, RTV-116 and RTV-118 are precatalyzed RTV liquid silicone rubbers. Having a low viscosity (approximately 300 to 400 poises) in the uncured state, these are readily pourable and offer self-leveling characteristics. Ready to use, they cure at room temperature to a firm, flexible, resilient rubber on exposure to moisture from the air. These sealants contain no solvent, cure with very little shrinkage and adhere to most surfaces without the aid of a primer.

Uncured Properties	RTV-112	RTV-118
Consistency	Pourable, like paint	Pourable, like paint
Color	White	Translucent
Specific Gravity	1.05	1.06
Solids Content	Contains no solvent	Contains no solvent
Non-Volatiles, % (24 Hrs./158°F)	95% (min.)	97% (min.)
Flow	Self-leveling	Self-leveling
Viscosity, Poises	300	350
Tack Free Time (77°F, 50% R.H.)	30 minutes	30 minutes
Application Rate gm/min. (Semco Gun with #440 Nozzle 0.125 orifice) Gun Pressure 90 ± 2 psi	1300	600

Electrical Properties for both RTV-112 and RTV-118

(ASTM pressed sheets cured one week at 77 F and 50 percent R.H. Specimens conditioned 24 hours at 75 F and 50 percent R.H. prior to electrical testing.)

Dielectric Strength Volts/Mil Thickness .065"	542
Dielectric Constant	
60 Hz	2.70
10^3 Hz	2.65
10^6 Hz	2.60
Dissipation Factor	
60 Hz	.0004
10^3 Hz	.0004
10^6 Hz	.0018
Volume Resistivity ohm-cm	2×10^{15}

Physical Properties

(ASTM pressed sheets cured at 77 F and 50 percent R.H.)

Property	2-Day Cure		7-Day Cure	
	RTV-112	RTV-118	RTV-112	RTV-118
Hardness, Shore A	30	25	32	27
Tensile Strength, psi	250	500	350	520
Elongation, %	300	400	350	350
Tear Strength Die B, lb/in.	25	35	25	33
Linear Shrinkage, %	1	0.2	1	0.3
Specific Gravity	1.05	1.06	1.05	1.06

Heat Aging Data

(Typical data obtained on ASTM pressed sheets cured one week at 77 F and 50 percent R.H.)

Property	Time at Temperature (after one week cure)							
	1 Wk/ 77°F		24 Hrs/ 300°F		24 Hrs/ 350°F		24 Hrs/ 400°F	
	RTV-112	RTV-118	RTV-112	RTV-118	RTV-112	RTV-118	RTV-112	RTV-118
Hardness, Shore A	32	27	32	26	30	25	28	26
Tensile Strength, psi	350	520	320	450	300	440	280	400
Elongation, %	350	350	300	300	290	290	280	280
Tear, Die B, lb/in.	25	33	28	30	30	30	33	33

Bonding

See general information concerning bonding characteristics of all G-E adhesive/sealants on page 7. Bond strengths of pourable RTV's are somewhat less than the bond strengths of thixotropic RTV's. Typical bond strength data available on RTV-112 and RTV-118 follow:

Substrate*	Adhesive Characteristics, Properties							
	Shear Strength†				Peel Strength‡			
	psi		% Cohesive Failure		lb/in.		% Cohesive Failure	
	RTV-112	RTV-118	RTV-112	RTV-118	RTV-112	RTV-118	RTV-112	RTV-118
Unprimed								
Copper	90-100	170	100	100	—	—	—	—
Aluminum 2024-T	80-90	170	95-100	100	6	20	90	100
Glass	**	**	100	100	—	—	—	—
Clear Acrylic	**	**	100	100	—	—	—	—
Primed — SS-4004								
Aluminum 2024-T6	140	140	100	100	8	20	100	100
Stainless Steel #304	140	140	100	100	—	—	—	—
Steel — Cold Roll #SE-1010	140	140	100	100	8.5	20	100	100

*20-mesh stainless steel screen bonded to substrate listed.
**Substrate broke before bond failed.
†70 hour cure at 77°F and 50% R.H.
‡7 day cure at 77°F and 50% R.H.

GENERAL APPLICATION and HANDLING SUGGESTIONS

Applying

RTV adhesive/sealants are applied directly from the tube and will air cure without any application of heat. They first form a surface skin with a complete cure progressing through the material. Under typical ambient conditions, they develop a tack-free surface in 15 to 30 minutes and cure through a ⅛-inch thickness in less than 24 hours. Lower temperatures and humidity will slow the rate of cure. Higher temperatures and humidity will accelerate the cure. (Optimum conditions are 90 F and 90% R.H.).

During initial stages of cure, a noticeable odor caused by acetic acid is produced. This odor will completely disappear at a later stage of cure. When using RTV on electrical or electronic parts, a preliminary check is suggested to determine the effects of small quantities of acetic acid on the specific component. In most cases, priming the part prior to applying the RTV will prevent any possibility of corrosion.

General Electric adhesive/sealants are designed and packaged for easy industrial application. For information concerning automatic dispensing for production line use, write for Technical Information Reports TSR-1711, TSR-1712 and appropriate CDS-598 equipment catalogs.

Bonding

RTV adhesive/sealants will bond to most clean surfaces without the aid of a primer. When cleaning, use a suitable solvent such as toluene, xylene, or acetone to remove all dirt and grease. When practical, wipe the surface dry with a clean cloth or paper towel prior to applying the sealant. Most materials can be bonded without priming (most metals, glass, ceramics, silicone rubber and many rigid plastics). Adhesion is obtained merely by applying RTV directly to the clean substrate, completely covering the entire surface, and allowing it to air cure.

The bond will improve with time—tests have shown that after three weeks the bond strength exceeds the cohesive strength of the rubber itself.

RTV will produce fair bonds, with adhesive rather than cohesive failure, to organic rubbers or flexible plastics that do not contain fugitive plasticizing agents.

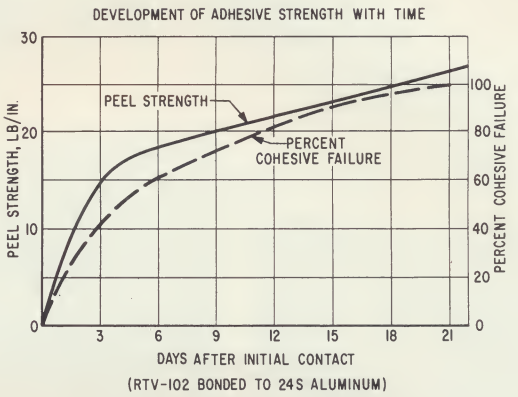
Due to the various types of bond strength required for different applications, it is suggested that a preliminary check be made to determine the bonding effects of RTV with specific materials.

Surface Preparation

When cleaning, use a suitable solvent such as toluene, xylene, or acetone to remove all dirt and grease. When practical, wipe the surface dry with a clean cloth or paper towel prior to applying the sealant.

Cure Time

The time required for RTV to form a maximum bond will vary according to type and thickness of material, humidity, temperature, etc. When bonding non-porous substrates, a one-inch width of RTV will completely cure within three weeks at ambient temperatures and humidities. Frequently, enough adhesion will develop within 60 minutes or less to permit handling the part. However, no appreciable stress should be exerted on the bond until it develops its full adhesive strength. If possible, allow three weeks for optimum results.



Clean Up and Removal

Before cure, solvent systems such as chlorinated hydrocarbons or aromatic hydrocarbons such as xylene are most effective.

After cure, chemical paint strippers such as Ordcostrip* No. 1 or Epoxystrip** No. T-251-C are very effective for removing well bonded RTV adhesives.

For additional information refer to Technical Information Report TSR-1709.

Storage and Shelf Life

RTV adhesive/sealants are commercially available in 3 and 12-ounce collapsible aluminum tubes, in 6-ounce plastic cartridges, and in bulk containers for use with automatic pressure guns and dispensing equipment. In their original aluminum tubes and stored at temperatures below 80 F, the useful shelf life will be in excess of one year from date of shipment. A 12-month shelf life may be expected in the plastic cartridges.

To prevent any curing within the tube, wipe off all excess material around the nozzle after each application and keep tightly sealed. If a small amount of cured RTV does form around the opening during exposure to air, it is easily removed and will not affect the remainder of material in the tube.

*Reg. Trademark of Oreland Research Co., Philadelphia, Pa.
**Reg. Trademark of Beck Equipment & Chemical Co., Cleveland, Ohio.

Standards

Standard test procedures developed for the rubber industry are frequently used in measuring silicone elastomers. The following standard tests have been used in obtaining test data shown here:

Specific Gravity	A.S.T.M.	D-792
Durometer, Hardness, Shore A	A.S.T.M.	D-676
Tensile Strength and Elongation	A.S.T.M.	D-412
Tear Resistance	A.S.T.M.	D-624
Dielectric Constant and Dissipation Factor	A.S.T.M.	D-150
Dielectric Strength	A.S.T.M.	D-149
Volume Resistivity	A.S.T.M.	D-257

Specifications

The properties shown in this data book have been determined from laboratory tests and are typical of the products. However, a reasonable degree of variation will occur in commercially produced material. The typical values shown here should not be used as a basis for specifications. For assistance and recommendations in the preparation of specifications, please contact the Silicone Products Department at Waterford, New York. Publication CDS-372 and CDS-531, "Adhesive/Sealant Specification Guides" are available upon request.

General Electric RTV Silicone Rubber Adhesive/Sealants may be ordered from your nearest G-E Silicone Sales Office or from your authorized G-E Silicone Agent or Distributor.

GENERAL ELECTRIC

SILICONE PRODUCTS DEPARTMENT
WATERFORD, NEW YORK • 12188

SILICONES

TECHNICAL DATA BOOK S-3C

RTV SILICONE RUBBER

ROOM TEMPERATURE VULCANIZING

GENERAL ELECTRIC

SILICONE PRODUCTS DEPARTMENT
WATERFORD, NEW YORK

RTV SILICONE RUBBER

General Electric RTV (room temperature vulcanizing) silicone rubber compounds are liquids or pastes that cure to strong, durable, resilient silicone rubber. The compounds described in this bulletin will cure at room temperature after the addition of a curing agent. Cure times can be varied from 10 minutes to 24 hours depending on the type and quantity of curing agent used. To meet widely varying application requirements a number of products are available covering a wide range of viscosities. In addition to these two-component materials, new ready-to-use RTV compounds which do not require the addition of a curing agent, are also available. They are described in Data Book S-2.

THESE PROPERTIES OF G-E RTV SILICONE RUBBER MAKE POSSIBLE IMPROVED PRODUCT PERFORMANCE, LOWER COSTS, SIMPLIFIED PRODUCTION METHODS:

- **RESISTANCE TO TEMPERATURE EXTREMES**

  Retains elastomeric properties over –190°F to 600°F temperature range. As a thermal barrier or ablative coating, useful up to 9000°F.

- **GOOD PHYSICAL AND ELECTRICAL PROPERTIES**

  Physical toughness and insulating ability are retained over a wide range of operating temperatures.

- **RESISTS OZONE, WEATHERING AND AGING**

  RTV silicone rubber stands up for long periods of time under conditons that break down ordinary elastomers.

- **CHEMICAL RESISTANCE**

  RTV resists attack from many common oils, solvents and chemicals.

- **GOOD BONDING ABILITY**

  Bonds to *properly primed surfaces* are stronger than the rubber itself.

- **EASY RELEASE**

  RTV silicone rubber has the inherent ability of silicones to release from sticking — ideal for molds or release coatings.

- **AVAILABLE IN WIDE RANGE OF VISCOSITIES**

  From 12 to 12,000 poises (1,200 to 1,200,000 centipoises).

- **CONTROLLABLE CURE TIMES**

  Cures at room temperature. Cure time can be varied from 10 minutes to 24 hours by proper curing agent selection.

- **MINIMUM SHRINKAGE**

  Shrinkage as low as 0.2%. RTV compounds are 100% solids, contain no solvents.

- **THICK SECTION CURE**

  RTV can easily be cured in thick sections.

- **RESILIENCE, ELASTICITY**

  RTV silicone rubber is a true elastomer, not a flexible plastic. It will absorb shock and vibration, retains elastomeric properties at extreme temperatures.

- **APPLICATION VERSATILITY**

  RTV compounds, available in viscosities from a pourable liquid to a thick paste, can be applied to objects of virtually any size and shape. Easy mixing and curing of RTV makes it an ideal "do-it-yourself" material for many applications.

SUBJECT INDEX

RTV SILICONE RUBBER — FOR HIGH TEMPERATURE SEALING AND CAULKING

RTV sealants are unequalled in terms of extreme temperature performance, durability, flexibility and ease of application. The thixotropic compounds, which flow easily under pressure — yet do not sag or flow in place — were developed specifically for meeting stringent sealing and caulking requirements. Latest developments include sealants which require neither curing agent nor primer, thus making application even easier. These tough, flexible sealants can be bonded to most materials with a bond strength exceeding the strength of rubber itself.

All RTV compounds in this group are finding increased usage throughout industry as sealants for production and in-plant repairs and in general maintenance applications.

RTV SILICONE RUBBER — FOR ELECTRICAL POTTING AND ENCAPSULATING

RTV silicone rubber's good electrical properties, along with its resistance to ozone and temperature extremes, have led to its wide use as electrical insulation. It is also used for potting electronic components and assemblies, for impregnating and encapsulating aircraft transformers and for dozens of other applications. Used for encapsulating new and rewound motors, RTV silicone rubber affords extra protection at lower cost.

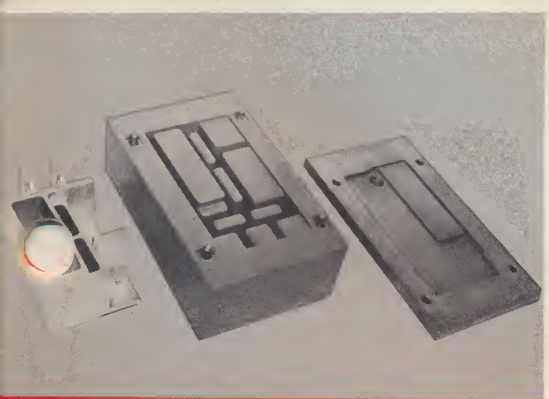
Since RTV compounds are 100% solids, they do not shrink significantly on curing. Voids and stress on encapsulated components are therefore eliminated. They are available in low viscosities for coil impregnation as well as encapsulation. Resilient silicone rubbers, they will not transmit shock and vibration as inflexible encapsulants do.

RTV SILICONE RUBBER — FOR HIGH AND LOW TEMPERATURE AEROSPACE APPLICATIONS

A complete new family of RTV silicone rubber compounds have been specially developed to provide low temperature flexibility and high temperature thermal insulation in aerospace applications. Also available in viscosities ranging from pourable liquids to heavy thixotropic pastes, these compounds provide greater resistance to temperature extremes because of their methyl-phenyl chemistry. This chemistry extends their low-temperature flexibility by approximately 100% to perform at temperatures below –150°F. At the same time, long-term resistance to high temperatures has been improved.

These particular RTV rubber compounds are used in the aerospace and electronics industry for electrical and mechanical insulation on apparatus operating in environments approaching cryogenic temperatures, for firewall sealants and heat shield fabrication, and in repair and patching applications.

RTV SILICONE RUBBER — AS A FLEXIBLE MOLD MATERIAL



No other flexible mold material offers the precise reproduction of surface detail possible with RTV silicone rubber. RTV molds are used in many applications formerly requiring expensive metal molds or hand-machine duplicate molds.

Molds made of RTV naturally and easily release parts cast in epoxy or polyester resins — *with no release agent required.* Since RTV cures with negligible shrinkage, mold configuration is identical with the original. In addition, its flexibility permits reproduction of complex shapes and undercuts.

RTV molds are used for low-cost plastic tooling, for models and prototype parts, for short runs of plastic parts and for replacement of broken parts. In these applications, RTV provides a combination of quality and economy previously unavailable with any mold material.

General Purpose RTV Silicone Rubber Compounds

General purpose RTV compounds have been developed for sealing, potting and encapsulating applications. In addition, they are used in the fabrication of flexible molds. They are available in viscosities varying from pouring liquids to spreadable pastes. The red RTV compounds provide excellent thermal resistance and are particularly useful in applications where high temperature is a factor.

All general purpose RTV compounds cure at room temperature on addition of a curing agent. They can be bonded to most plastics, metals, glass, etc. after the addition of a primer.

POURABLE LIQUIDS

RTV-11

RTV-11 has a viscosity of 120 poises — equivalent to that of house paints. Used principally for electrical — electronic potting and encapsulating and in molding applications, it is very flexible when cured. Offering moderate physical properties desired for potting application, RTV-11 possesses excellent electrical properties. White in color, it can be pigmented where desired.

RTV-21

RTV-21 is an easily pourable compound with a moderate viscosity of 250 poises. Typical applications include potting, encapsulating and flexible mold making. It is pink in color. *In terms of shelf life and product handling dependability, RTV-21 is an improvement over previously available RTV-20.*

RTV-30

With a moderate viscosity of 250 poises, this material provides an outstanding combination of physical properties and resistance to heat. RTV-30 is an excellent choice for flexible molds, electrical potting and certain sealing applications. Used for encapsulating transformers and coils, it provides outstanding heat resistance. It will withstand heat at 600°F for 72 hours or more with little loss in flexibility. RTV-30 is a red silicone compound.

RTV-41

RTV-41 stems from an advanced technology that achieves a product with greatly improved uniformity of cure and much improved shelf life. A compound with a moderate viscosity of 400 poises, it is used for molding, electrical and electronic potting and wherever the high temperature stability and heat resistance of the red silicone compounds are not required. *White in color for pigmenting, where desired, RTV-41 is an improved version of previously available RTV-40.*

RTV-60

RTV-60 is the most widely used of all RTV compounds. With a viscosity of about 500 poises, it will pour without difficulty. It provides the best physical, chemical and heat resistant properties of any pourable RTV compound. In addition, it is outstanding in terms of tensile strength, shear strength and bondability, thus making it an excellent sealant/adhesive. Red in color, RTV-60 is used for encapsulation of transformers, coils and motors, and for fabrication of rubber parts where its toughness provides maximum protection. Because of its very low shrinkage, greater firmness, and superior physical properties, it is widely used for release applications and flexible molds.

THIXOTROPIC PASTES

RTV-77

RTV-77 has a viscosity in the range of 5,000 to 12,000 poises. Because it is highly thixotropic, it is particularly suitable for application under pressure, as from a caulking gun. It is used as a sealing, patching and caulking material and for thermal insulation where a high level of radiant heat is involved. A white compound, RTV-77 can be pigmented if desirable.

RTV-88

RTV-88, a red, thixotropic spreadable paste with a viscosity range of 5,000 to 12,000 poises, is used as a sealing and caulking compound and a thermal insulation material. Its high degree of thixotropy encourages easy flow under pressure, but the compound exhibits almost zero flow under static conditions.

SPREADABLE PASTES

RTV-90

RTV-90, the least fluid of the RTV compounds, exhibits outstanding physical properties. A fairly stiff paste with a viscosity of 12,000 poises, it can be applied with a caulking gun under pressure, or with a putty knife or spatula. Red in color, RTV-90 is used for sealing and caulking, primarily in high-temperature applications.

Properties of RTV General Purpose Compounds

The properties shown in this data book have been determined from laboratory tests and are typical of the RTV compounds described. *Values indicated should not be used as the basis for specifications.* For assistance in preparation of specifications, contact General Electric Silicone Products Department, Waterford, New York. There is no significant change in physical properties when curing agent concentration is varied within recommended limits.

	RTV-11	RTV-20(1)	RTV-21	RTV-30	RTV-40(1)	RTV-41	RTV-60	RTV-77	RTV-88	RTV-90
TYPICAL UNCURED PROPERTIES										
Color	White	Pink	Pink	Red	White	White	Red	White	Red	Red
Consistency	Easily Pourable	Pourable	Pourable	Pourable	Pourable	Pourable	Pourable	Spreadable Thixotropic Pastes		Stiff Paste
Viscosity, Poises										
Nominal	120(2)	250(3)	250(2)	250(2)	400(3)	400(2)	500(3)	6,000(4)	6,000(4)	12,000(5)
Range	80-180	190-340	200-350	190-320	300-600	350-500	400-700	5,000-12,000		9,000-18,000
Non Volatile,(6) % (min.)	98	98	98	98	98	98	98	98	98	98
Specific Gravity	1.18	1.35	1.31	1.45	1.35	1.31	1.47	1.33	1.48	1.50
TYPICAL CURED PROPERTIES	(Catalyzed with 0.5% Dibutyl-tin-dilaurate. ASTM Sheets — 6" x 6" x 0.075", cold pressed 16-24 hrs. @ 77°F plus one week in open @ 77°F and 50% RH)									
Specific Gravity	1.18	1.35	1.31	1.45	1.35	1.31	1.47	1.33	1.48	1.50
Hardness, Shore A Durometer	45	50	50	60	55	50	60	50	65	60
Tensile Strength, psi	350	450	550	850	550	500	800	500	750	750
Elongation, %	180	140	180	130	120	200	130	220	110	150
Tear Resistance, die B, lb/in	15	25	30	40	25	30	40	25	40	75
Brittle Point, °F	Below — 90°F									
Linear Shrinkage, %	0.2 — 0.6									
Adhesion (SS-4004 Primer) (Cohesive Failure)										
Peel Strength, lb/in (bonded to primed stainless steel)	3	3.5	5.0	6.0	4.0	5.0	4.5	3.0	5.5	6.5
Shear Strength, lb/sq in (Primed steel)	200	450	275	450	350	275	500	250	350	500
TYPICAL ELECTRICAL PROPERTIES	(Catalyzed with 0.5% Dibutyl-tin-dilaurate. ASTM sheets cold pressed 16-24 hrs. @ 77°F, plus one week in open at 77°F and 50% RH. Specimen conditioned 24 hrs. @ 23°C (75°F) and 50% RH prior to testing for electrical characteristics.)									
Dielectric Strength, Volts/mil										
0.040 in. thick	630	650	650	625	600	600	600	650	575	600
0.075 in. thick	500	500	500	475	500	500	500	475	450	500
Dielectric Constant,										
60 cps	3.6	3.6	3.4	4.0	4.2	3.8	3.7	4.0	4.0	4.0
10^6 cps	3.1	3.1	3.4	3.6	4.0	3.5	3.5	3.7	3.5	3.7
Dissipation Factor,										
60 cps	.019	.011	.01	.025	.02	.14	.020	.018	.023	.020
10^6 cps	.005	.003	.003	.002	.003	.007	.003	.009	.005	.003
Volume Resistivity, OHM-Cm.	6×10^{14}	5×10^{13}	8.8×10^{14}	2.9×10^{15}	1×10^{14}	1.5×10^{14}	1.3×10^{14}	1×10^{15}	1×10^{14}	1.3×10^{14}

(1) Material exhibits limited shelf life and variable cure characteristics. Recommended selections are RTV-21 and RTV-41.

(2) Brookfield Viscometer, RVF Model No. 5 spindle, 4 RPM.

(3) Brookfield Viscometer, RVF Model No. 6 Spindle, 10 RPM.

(4) Brookfield Viscometer, RVF Model No. 7 spindle, 2 RPM.

(5) Brookfield Viscometer, RVF or HBF Model No. 7 spindle, 2 RPM.

(6) 100% Solids — Contains No Solvents. % Non Volatile after 24 hours @ 158°F.

ELECTRICAL PROPERTIES

Like all silicone rubber, cured RTV has excellent electrical properties which are retained over a wide temperature range. Properties shown in the preceding table were determined from tests run on ASTM sheets cured at room temperature using dibutyl tin dilaurate curing agent. Power factor and dielectric constant were determined with both a General Radio Capacitance Bridge, 125 volts, and a Schering Bridge, 500 volts. Measurements at 1 Mc were made with a Boonton Q-Meter. Volume resistivity was measured at 500 volts stress. Dielectric strengths were measured on .040 inch sheets with ¼ inch electrodes with a rise of 500 volts/sec. Dielectric strength measurements will vary with specimen thickness as shown in the table at right. Added post-bake cycles were conducted in the circulating hot air ovens commonly used for curing silicone rubber. For more information, refer to TSR-1267 (Volume Resistivity of RTV-60 at Various Temperatures) and TSR-1705 (Electrical Properties of RTV During Cure).

EFFECT OF THICKNESS ON DIELECTRIC STRENGTH MEASUREMENTS*

Sample Thickness, Mils	Dielectric Strength Volts/Mil
20	860
40	630
80	425
100	370

* Tests made on RTV-11 cured at room temperature. Other RTV compounds behave similarly.

TEMPERATURE RESISTANCE

RTV compounds, like the general purpose, heat curing silicone rubbers, exhibit excellent resistance to temperature extremes. The general purpose RTV's offer heat resistance as high as 600°F and above and have low-temperature flexibility at –75°F with a brittle point of approximately –95°F. Heat aging data appears in the table below.

Where the retention of elastomeric properties is essential, the red compounds offer short-time heat resistance up to 600°F (white compounds up to 500°F). For continuous operation, red compounds are useful up to 500°F (white compounds up to 400°F) with retention of elastomeric properties. For applications where elastomeric properties are not essential, the integrity of the material and electrical insulating ability are retained for extended periods at 600°F and above. For thermal insulation and ablative applications, other RTV products offer short-time resistance to temperatures up to 9000°F. For additional information on long-term heat resistance of these RTV silicone rubber compounds, write for TSR-1238 and TSR-1264.

TYPICAL HEAT AGING DATA ASTM sheets cured per "Cured Properties" section of preceding table, plus heat aging conditions shown below.

	RTV-11	RTV-20	RTV-21	RTV-30		RTV-40	RTV-41			RTV-60			RTV-77		RTV-88		RTV-90		
Heat Aging Conditions	24 hrs/ 480F	24 hrs/ 480F	70 hrs/ 300F	24 hrs/ 480F	40 hrs/ 600F	72 hrs/ 400F	24 hrs/ 480F	48 hrs/ 480F	144 hrs/ 480F	24 hrs/ 480F	4300 hrs/ 450F	40 hrs/ 600F	24 hrs/ 400F	24 hrs/ 480F	24 hrs/ 400F	24 hrs/ 480F	24 hrs/ 400F	4300 hrs/ 450F	40 hrs/ 600F
Durometer Hardness, Shore A	48	50	38	50	65	58	38	39	40	65	65	75	43	41	60	60	60	67	65
Tensile Strength, psi	380	430	300	660	680	550	415	415	460	650	600	600	320	320	660	620	750	600	600
Elongation, %	180	140	100	130	80	120	190	180	200	110	90	70	180	150	100	90	150	100	100
Tear Resistance, Die B, lbs/in.	20	25	.....	25	25	25	.....	.....	.....	35	28	40	.....	.....	30	23	50	40	35
Peel Strength, lb/in. (bonded to primed 18-8 stainless steel)	3.0	.....	.....	.....	.....	.....	.....	.....	.....	3.8*	.....	.....	.....	4*	4*	4*	5.0*	.....	.....

* Cohesive failure.

THERMAL CONDUCTIVITY AND THERMAL EXPANSION

Thermal conductivity is dependent upon the amount and type of filler combined with the RTV polymer. A typical value for RTV compounds is 0.18 btu-ft/ft²-hr-°F when measured from 100 to 200°F.

Another significant consideration relating to filler and RTV polymer combination is the Linear Coefficient of Thermal Expansion. A typical value for RTV compounds is in the range of 11.5 to 14 x 10^{-5} in./in./°F. For more information, refer to TSR-1260 and TSR-1265.

THERMAL CONDUCTIVITY OF RTV COMPOUNDS

Compound	Test Temp.	BTU-ft/Hr, Ft², °F
RTV-11	77°F	0.17
	225°F	0.15
RTV-21	77°F	0.18
	225°F	0.16
RTV-60	200°F	0.18
RTV-88	77°F	.....
	200°F	0.18

COMPRESSION SET

When RTV silicone rubber is used in sealing applications where the rubber will be in compression, particularly at elevated temperatures, resistance to compression set becomes an important property. Like other silicone rubbers, the RTV compounds show excellent resistance to compression set even under severe conditions of pressure and temperature. Compression set values can be improved by a post cure in an oven — e.g., at 480°F for 24 hours. The table at the right gives some typical compression set values; for additional data, write for TSR-1227.

TYPICAL COMPRESSION SET VALUES
(RTV-60, 0.1% Dibutyl Tin Dilaurate)
Percent Compression Set

Test Conditions ASTM D-395	Cure	
	72 hrs/75F	+24 hrs/480F
22 hrs/212F	52	14
22 hrs/350F	89	12

PERFORMANCE IN VACUUM

Tests made on samples of RTV-60 at elevated temperatures and vacuum of 10^{-4} mm Hg indicate that cured RTV compounds suffer very little weight loss under high-vacuum conditions.

WEIGHT LOSS OF RTV-60, %
(10^{-4} mm Hg Vacuum)

Temperature	Time (Hours) 24	89	168
77F	0.03	0.09	0.11
212F	0.54	0.85	1.00
392F	1.72	1.73	1.80

RESISTANCE TO FUELS AND SOLVENTS

RTV silicone rubber offers excellent resistance to intermittent contact with aircraft fuels and many commercial solvents. For more data on solvent resistance, write for bulletins TSR-1228, TSR-1234, TSR-1257 and TSR-1708.

SOLVENT IMMERSION EFFECTS (Cold Pressed ASTM Sheets Cured 72 hrs/77°F with 0.5% Dibutyl Tin Dilaurate)

		RTV-11	RTV-60	RTV-90
Original Properties	Tensile Strength, psi	400	700	750
	Elongation, %	160	110	150
	Hardness, Shore A	45	60	60
ASTM #1 Oil, 70 hrs/300°F	Tensile Strength, psi	300	650	490
	Elongation, %	190	110	100
	Hardness, Shore A	45	55	52
	Volume Change, %	+ 10	+ 4	+ 3
ASTM #3 Oil, 70 hrs/300°F	Tensile Strength, psi	310	425	400
	Elongation, %	130	70	190
	Hardness, Shore A	35	45	40
	Volume Change, %	+ 35	+ 30	+ 40
Oronite 8200, 70 hrs/300°F	Tensile Strength, psi	420	650	500
	Elongation, %	160	80	80
	Hardness, Shore A	25	52	48
	Volume Change, %	+ 80	+ 50	+ 45
Skydrol 500, 70 hrs/212°F	Tensile Strength, psi	400	275	350
	Elongation, %	100	70	150
	Hardness, Shore A	40	48	45
	Volume Change, %	+ 5	+ 25	+ 15
JP-4 Jet Fuel, 168 hrs/77°F	Tensile Strength, psi	400	600	425
	Elongation, %	100	60	80
	Hardness, Shore A	35	53	50
	Volume Change, %	+130	+ 90	+130
Silicone Fluid, SF-96 (100) 70 hrs/158°F	Tensile Strength, psi	240	280	250
	Elongation, %	150	80	150
	Hardness, Shore A	25	45	35
	Volume Change, %	+ 58	+ 30	+ 50

OZONE RESISTANCE

All silicone rubbers offer outstanding ozone resistance and the RTV compounds are no exception. In testing, RTV compounds have been exposed to an ozone concentration of 150 parts per million for 336 hours without any deterioration or cracking. The ozone resistance of RTV compounds is definitely superior to polysulfide, neoprene, butyl and natural rubbers.

In addition, RTV silicone rubber is not affected by air oxidation and the effects of light frequencies which do deteriorate many natural and synthetic rubbers. For more information, write for TSR-1238 and TSR-1239.

Methyl-Phenyl RTV Compounds With Extreme Low Temperature Flexibility and High Temperature Thermal Insulation for Aerospace Applications

There are four General Electric RTV silicone rubber compounds specially developed for meeting the extreme temperature requirements found in many aerospace applications. Identified as RTV-511, RTV-560, RTV-577 and RTV-580, these products differ primarily in viscosity and range from easily pourable liquids to heavy thixotropic pastes. These methyl-phenyl compounds, like the general purpose RTV's, cure at room temperatures, after the addition of a curing agent, to form a durable and resilient protective silicone rubber. They are similar to RTV-11, RTV-60, RTV-77 and RTV-88 in both processing characteristics and cured properties. In addition, the methyl phenyl chemistry of these new products offers improved resistance to low temperatures and improved flame retardancy without sacrificing any properties inherent in other RTV compounds.

POURABLE LIQUIDS

RTV-511

RTV-511 is an easily pourable silicone rubber compound with a low viscosity of about 200 poises. In can be used for potting and encapsulating where extreme low temperature flexibility is needed. It will maintain its flexibility in temperatures below –150°F. In addition, RTV-511 is an excellent material for cast-in-place heat shields and ablative coatings. Its white color provides good thermal reflectance.

RTV-560

RTV-560 is a red, methyl-phenyl compound with a moderate viscosity of about 400 poises. It provides the best thermal stability and oxidation resistance of any pourable RTV compound available. It is applied where extreme temperature performance is essential. RTV-560 is presently utilized as mechanical and electrical insulation on apparatus operating in environments approaching cryogenic temperatures. In addition, it is used for thermal insulation as a firewall sealant, in the fabrication of heat shields and in ablative coating applications.

THIXOTROPIC PASTES

RTV-577

RTV-577 is a white, spreadable paste with a viscosity of about 6000 poises. It is used in applications where extreme low temperature flexibility (below –150°F) is required. RTV-577 is currently used as a sealing, patching and caulking material, for fabrication of heat shields, as an ablative coating, and in a range of electrical and mechanical applications.

RTV-580

A red, thixotropic compound with a viscosity of 8000 poises, RTV-580 is used primarily for patching, caulking and sealing of parts and components subject to extreme high and low temperatures. Like the other RTV silicone rubber compounds in this group, it is a material with a methyl-phenyl chemical structure.

Properties of Methyl-Phenyl RTV Compounds

The properties shown in this data book have been determined from laboratory tests and are typical of those for the methyl-phenyl RTV compounds. These values should not be used as a basis for specifications. For assistance in the preparation of specifications, contact General Electric Silicone Products Department, Waterford, New York.

	RTV-511	RTV-560	RTV-577	RTV-580
TYPICAL UNCURED PROPERTIES				
Color	White	Red	White	Red
Viscosity[1], poises	200*	400*	6000**	8000**
Consistency	Easily Pourable Liquid	Pourable Liquid	Smooth, Spreadable Thixotropic paste	Smooth, Spreadable Thixotropic paste
Non-Volatile Content[2], %, (min)	98	98	98	98
Specific Gravity	1.20	1.42	1.35	1.49
TYPICAL CURED PROPERTIES	(Catalyzed with 0.5% Dibutyl-tin-dilaurate. ASTM Sheets—6" x 6" x 0.075", cold pressed 16-24 hrs. @ 77°F plus one week in open @ 77°F and 50% RH)			
Specific Gravity	1.20	1.42	1.35	1.49
Hardness, Shore A	45	60	50	65
Tensile Strength, psi	350	800	480	800
Elongation, %	180	160	180	110
Tear Resistance, die B, lb/in.	25	45	25	40
Bashore Resilience, %	60	70	60	60
Brittle Point	Below —150°F	Below —150°F	Below —150°F	Below —150°F

	RTV-511	RTV-560	RTV-577	RTV-580
TYPICAL ELECTRICAL PROPERTIES (Catalyzed with 0.5% Dibutyl-tin-dilaurate. ASTM sheets cold pressed 16-24 hrs. @ 77°F, plus one week in open at 77°F and 50% RH. Specimen conditioned 24 hrs. @ 23°C (75°F) and 50% RH prior to testing for electrical characteristics.)				
Dielectric Strength, Volts/mil.				
0.030 in. thick	930	825	—	—
0.070 in. thick	590	550	—	—
0.075 in. thick	—	—	485	470
0.080 in. thick	500	490	—	—
Dielectric Constant				
10^2 cps	4.1	4.4	4.1	4.1
10^3 cps	4.0	4.3	4.0	4.0
10^5 cps	3.9	4.1	3.8	3.8
10^6 cps	3.4	—	3.7	3.7
Dissipation Factor				
10^2 cps	.005	.006	—	—
10^3 cps	.003	.005	.008	.008
10^5 cps	.002	.002	.006	.006
10^6 cps	.007	—	.010	—
Vol. Resistivity, OHM-cm.	1×10^{15}	1×10^{15}	1×10^{15}	1×10^{15}

TYPICAL HEAT AGING DATA (ASTM Sheets cured per "Cured Properties" section above, plus heat aging conditions shown below)

Heat Aging Conditions	24 hrs. @ 400°F	24 hrs. @ 480°F	24 hrs. @ 400°F	24 hrs. @ 480°F	24 hrs. @ 400°F	24 hrs. @ 480°F	24 hrs. @ 400°F	24 hrs. @ 480°F
Hardness, Shore A	43	40	55	50	45	50	60	65
Tensile Strength, psi	420	350	750	650	350	340	700	600
Elongation, %	190	170	150	150	140	120	100	80
Tear Resistance, Die B, lb/in.	20	20	35	35	20	15	35	32
Bashore Resilience, %	65	60	70	60	60	55	55	50
Compression Set, Method B, 22 hrs./350°F, %	—	22	—	24	30	24	30	24

(1) Brookfield Viscometer
*RVF Model, No. 5 spindle, 4 rpm
**RVF Model, No. 7 spindle, 2 rpm

(2) 100% Solids — Contains no solvents, % Non-Volatile after 24 hrs. at 158°F.

HIGH AND LOW TEMPERATURE RESISTANCE

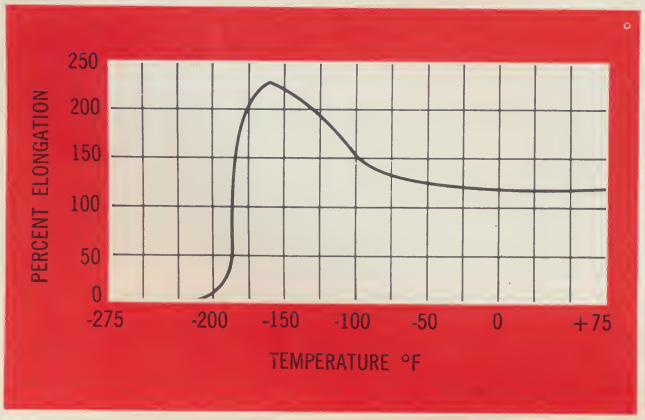
The ability of these new RTV compounds to provide improved resistance to temperature extremes is a result of their chemical structure. In general, the RTV silicone rubbers are processed using a dimethyl silicone polymer with suitable inorganic reinforcing fillers. However, by replacing some of the methyl groups with phenyl groups, resistance to temperature extremes has been improved.

As a result, the four new methyl-phenyl RTV compounds have extended their low temperature flexibility by approximately 100% to perform at –150°F and below. At the same time, as indicated by TYPICAL HEAT AGE DATA preceding, their methyl-phenyl structure has also improved long term resistance to high temperatures and has extended their usefulness as a thermal insulation.

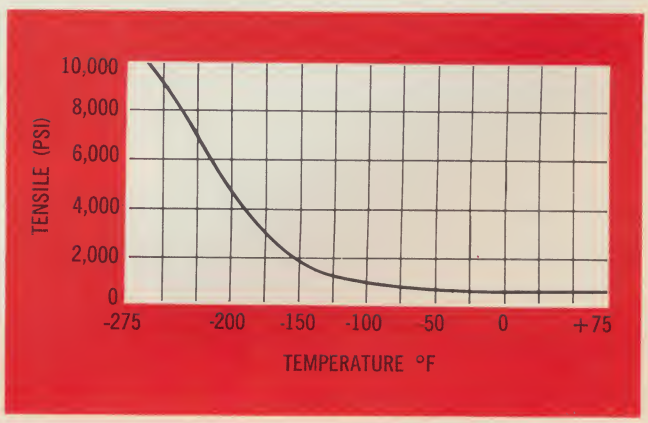
LOW TEMPERATURE FLEXIBILITY

Since all of the General Electric RTV-500 series products are based on the same polymer chemistry, the following test data is characteristic of this group of methyl-phenyl compounds. For additional information, refer to CDS-554 (RTV Silicones as Sealants and Adhesives for Cryogenic Applications) and TSR-1701 (Extreme Low Temperature RTV's).

RTV-560
RUBBER ELONGATION vs. TEMPERATURE



RTV-560
TENSILE STRENGTH vs. TEMPERATURE



THERMAL CONDUCTIVITY AND THERMAL EXPANSION

Having filler-polymer formulations similar to the general purpose RTV compounds, the RTV-500 series materials also exhibit thermal conductive values in the order of 0.18 BTU-ft/hr, ft^2, °F when measured at temperatures around 200°F.

Another significant consideration, relating to filler and RTV polymer combination is the Linear Coefficient of Thermal Expansion. A typical value for these RTV compounds is in the range of 11 to 13 x 10^{-5} in./in., °F over the temperature range of 0° to 400°F.

THERMAL CONDUCTIVITY OF RTV-500 SERIES COMPOUNDS

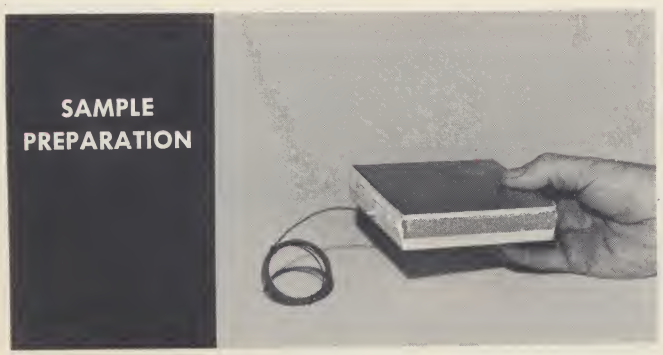
Compound	Test Temp.	BTU-ft./hr., Ft^2, °F
RTV-511	77°F	0.15
	225°F	0.15
RTV-560	77°F	------
	315°F	0.19

FLAME RESISTANCE

These methyl-phenyl compounds have exhibited good resistance to flame tests too severe for standard available RTV's. For example, RTV-511 and RTV-560 fail to propagate flame when subjected to repeated 15 second exposures to a 2000°F flame test (ref. Underwriters' Laboratories 482, 10th Edition, October 1958, paragraphs 162, 167.)

THERMAL INSULATION/ABLATION

In the evaluation of these materials in simulated test conditions for ablative type compounds, oxy-acetylene torch test data has been obtained on all four methyl-phenyl RTV silicone rubbers. The significance of the resulting test data is very much dependent upon a complete description and understanding of sample preparation and test conditions.



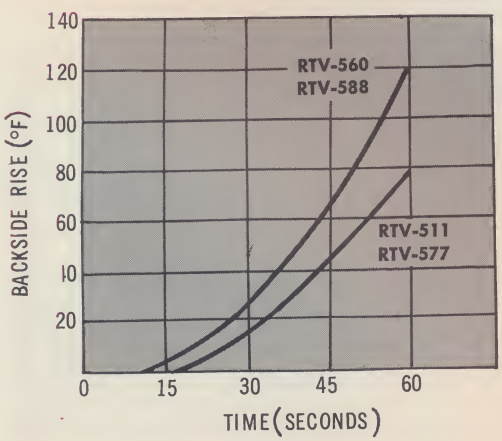
A thermocouple is mounted to a 4″ x 4″ x 0.25″ molded RTV rubber test specimen. The thermocouple side of the RTV specimen is bonded with RTV-511 to ½″ thick cork section. A 0.100″ alclad aluminum panel is then bonded to the open side of the cork with RTV-511 to prevent specimen deformation when subjected to the high thermal stress.

TEST CONDITIONS:

Torch Nozzle	Victor 10, Type 1
Oxygen Flow	63.5 ft^3/hr. @ STP
Acetylene Flow	55 ft^3/hr. @ STP
Oxygen Pressure	10 psi
Acetylene Pressure	10 psi
Angle of incidence of torch	20°
Test Time	60 ±1 second
Flame Temperature (approx.)	5000°F

Based upon these test conditions, the heat dissipation and char/ash characteristics of these methyl-phenyl compounds are a definite advantage in selecting them for ablative and thermal insulations.

OXY-ACETYLENE TORCH TEST RTV-500 SERIES



OXY-ACETYLENE TORCH TEST DATA*

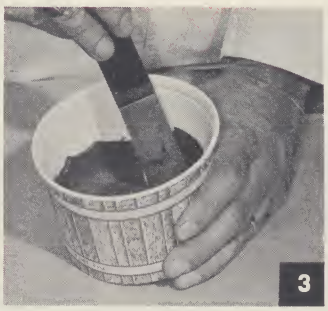
Product	Backside Temp. Rise** (°F)	Ablation Rate (mil/sec.)	Mass Loss Rate (lb/ft^2/sec)	Compound Density (gms/cm^3)
RTV-511	82	0.77	4.8×10^{-3}	1.20
RTV-560	122	0.63	4.6×10^{-3}	1.42
RTV-577	79	0.68	4.8×10^{-3}	1.35
RTV-580	122	0.48	3.7×10^{-3}	1.49

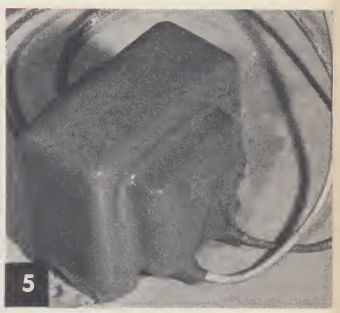
* Test Reliability (2 sigma limits/95% confidence)
Per: RTV-511 (10 samples): Avg. ΔT 81.6 ±2.6°F (or ±6.5%) thermocouple reading.
Avg. Loss Rate 0.77 ±0.28 (or ±36%) test error in char measurements for calculation.

** After 60 ±1 seconds.

How To Use General Electric's RTV Compounds

● RTV-11, -21, -30, -41, -60, -77, -88 and -90 ● RTV-511, -560, 577, and -580





1. PLACE SUFFICIENT RTV for your application in a container — cardboard will do — for weighing and mixing. RTV should first be weighed to determine the correct amount of curing agent (see Step 2). For controlled cure rates, weigh RTV on a triple beam balance or equivalent-type scale. Otherwise, the amount of RTV need only be estimated.

2. MEASURE CURING AGENT. After weighing RTV, add sufficient curing agent. For most general purpose applications, approximately 0.5% dibutyl tin dilaurate (Thermolite-12) curing agent, by weight, is most suitable. For an extra fast cure, use 0.5 to 1% tin octoate (Nuocure 28). The table below provides an easy guide for measuring curing agent for most applications. More detailed information on curing agent selection appears on page 12

3. MIXING, Thoroughly mix the measured curing agent with the RTV, using a spatula, paint stick, etc. For large quantities, pony mixers or dough mixers are recommended. If power equipment, such as a power-drill-driven paint stirrer is used, care must be taken to avoid air entrapment that will result in voids. In most cases deaeration is recommended after curing agent mixing to eliminate this problem. For high viscosity materials such as RTV-77,-88, -90,- 577 and-580 deaeration is not recommended.

An RTV compound will slowly increase in viscosity after addition of the curing agent. Therefore, it is necessary to apply the material as rapidly as possible after the curing agent is added. To extend the work life of catalyzed RTV, it should be refrigerated (see "Controlling Cure Times" p. 14).

4. APPLYING. The RTV may now be applied by any convenient method, such as dipping, pouring or brushing. For production line application, RTV is often applied from a pressure gun. RTV may also be sprayed in thin films (see pg. 19).

Particularly in potting and impregnating applications, care must be taken to avoid air entrapment. A vacuum treatment or deaeration after curing agent mixing should be used (see pg. 14) to assure that any air bubbles are removed from the compound or the component.

For maximum impregnation of units such as coils, transformers, etc., the vacuum treatment should be followed immediately by the application of air pressure. Pressures of 10 to 25 psi will usually insure thorough penetration of the RTV compounds.

5. CURING. The RTV will now cure at room temperature. If desired the cure rate can be accelerated by applying heat (see "Controlling Cure Times").

MEASURING GUIDE* To Obtain Catalyst Concentrations, Weight Percent Addition

Weight of RTV		TIN OCTOATE[1] (Specific Gravity: 1.26) 0.1%		0.3%		DIBUTYL TIN DILAURATE[2] (Specific Gravity: 1.05) 0.1%		0.5%	
Grams	Ozs.	Grams	Drops**	Grams	Drops**	Grams	Drops**	Grams	Drops**
20	....	.02	1	.06	3	.02	1	.10	5
57	2	.06	3	.18	9	.06	3	.29	14
100	....	.10	4	.30	12	.10	5	.50	25
200	....	.20	9	.60	26	.20	10	1.00	50
454	16	.45	21	1.35	63	.45	23	2.27	118
Grams	Lbs.								
2268	5	2.3	....	6.9	....	2.3	....	11.3	....
4536	10	4.5	....	13.5	....	4.5	....	22.7	....

* Amount of catalyst shown in this table is intended only to be used as a guide. Other amounts may be suitable, depending upon type and concentration used.

** Measured from conventional-type medicine dropper. Drops are approximation. Use volumetric addition and syringe when more precise measurements are required.

(1) Nuocure 28 by Nuodex Products Company (or equivalent).

(2) Thermolite-12 by M & T Chemical Corporation (or equivalent).

Curing Agent Selection

● RTV-11, -21, -30, -41, -60, -77, -88 and -90 ● RTV-511, -560, -577, and -580

CURING AGENTS

The curing agents (sometimes incorrectly called "accelerators") used to effect the cure of these RTV compounds are for the most part metallic soaps, liquid in nature. Since they are used in very small quantities, considerable care must be taken to insure that the total required quantity is thoroughly dispersed throughout the RTV compound. Insufficient mixing results in rubber with non-uniform cure and poor properties.

Specific curing agents most frequently used with RTV compounds are listed below. With small quantities of RTV (up to one gallon), General Electric supplies the curing agent. When using larger quantities, it is more advantageous for the user to order curing agent directly from the curing agent manufacturer, as indicated below.

DIBUTYL TIN DILAURATE is the curing agent, available under the name THERMOLITE-12[1], or equivalent, generally preferred for most applications. Most frequently added in concentrations ranging from 0.1 percent up to 0.5 percent by weight, it cures at moderate speeds and has been found most reliable of all curing agents available. The effect of varying dibutyl tin dilaurate concentration on cure rate is shown in the table of typical cure rates. Varying concentration within the limits shown does not generally affect final properties after complete rubber cure.

Handling Precautions** Dibutyl tin dilaurate (Thermolite-12), like all organotin compounds, is not a completely non-toxic material. Prolonged exposure directly or through contaminated clothing may lead to irritation of the skin. Exposed parts of the body and contaminated clothing should be washed thoroughly with soap and water. In the case of accidental contact with the eyes, irrigate with water immediately and get medical attention.

Thermolite-12 (dibutyl tin dilaurate) is manufactured by M&T Chemical Corporation, Rahway, New Jersey. "Thermolite" is a registered trademark of M&T Chemical Corporation.

TIN OCTOATE is the fastest curing of generally available curing agents. It is sold under the trade name Nuocure[2] 28 and is used when cure time of 30 minutes or less is required, usually at levels up to 1% by weight. Because of its fast cure, the catalyzed RTV must be poured or applied immediately after addition and thorough mixing. This material is stannous octoate with a stannous tin concentration of 28 percent. It is manufactured and sold by the Nuodex Products Company, Elizabeth, New Jersey, and "Nuocure" is their trademark.

LEAD OCTOATE, available under the name Silicure L-24, or equivalent, was one of the first curing agents used with RTV, but has now been largely replaced by dibutyl tin dilaurate. It is available from Nuodex Products Company (address above) as lead octoate 24%.

Handling Precautions** Lead octoate, like all lead compounds, is toxic and should not be swallowed. Prolonged exposure directly or through contaminated clothing may lead to irritation of the skin. Exposed parts of the body and contaminated clothing should be washed thoroughly with soap and water. In the case of accidental contact with the eyes, irrigate with water immediately and get medical attention. If cured RTV is to be used in contact with food products, lead octoate should not be used as the curing agent.

PASTE CURING AGENTS — The most widely used curing agents or catalysts for RTV silicone rubber compounds are metal soap compounds, normally liquids such as dibutyl tin dilaurate. However, addition of liquid curing agents involves measurement of very small quantities — as little as .05 to 0.5%. Greater accuracy and, therefore, greater control over curing rate, can be achieved by use of RTV-9910, RTV-9930 and RTV-9950 paste curing agents in which the active curing ingredient has been diluted with suitable silicone base materials.

The paste curing agent formulations contain only a small percentage of the liquid curing agent, thus a larger volume of paste is necessary to give equivalent cure characteristics. This larger amount of paste curing agent can be measured faster as well as with greater accuracy by production personnel and also insures greater uniformity in automatic metering-mixing-dispensing machines. Moreover, these materials are produced in colors designed to provide maximum possible contrast with the RTV compounds themselves, thus assuring thorough mixing in hand operations.

RTV-9910, RTV-9930 and RTV-9950 are based on dibutyl tin dilaurate as the active curing agent ingredient. The final two digits of the product designations indicate the concentration of dibutyl tin dilaurate in hundredths of a percent when mixed with RTV compound at 10:1 ratio: 0.10, 0.30, and 0.50 percent respectively. For complete information on cure characteristics, refer to TSR-1715.

TYPICAL PRODUCT PROPERTIES

Paste Curing Agent*	Color	Specific Gravity	Liquid Curing Agent Equivalent when mixed at 10:1 ratio
RTV-9910	Orange-Tan	1.84	0.1% Dibutyl tin dilaurate
RTV-9930	Yellow	1.88	0.3% Dibutyl tin dilaurate
RTV-9950	White	1.75	0.5% Dibutyl tin dilaurate

* A low-viscosity (250 poises) liquid version of each of the above materials is also available, designated as RTV-9910LV, RTV-9930LV and RTV-9950LV.

[1] Reg. T.M. M&T Chemicals.
** Taken from manufacturer's literature
[2] T.M. Nuodex Products.

STORAGE AND HANDLING OF PASTE CURING AGENTS

RTV paste catalysts should be stored in clean, covered containers, preferably kept at temperatures between 70° and 85°F. If during shipment the products are exposed to lower temperatures, crystallization of the active curing agent may occur, which may be evidenced by stiffening of the paste. If this does take place, warm the product above 70°F and hold for some period of time (preferably overnight), stirring occasionally until normal viscosity is restored.

TYPICAL ROOM TEMPERATURE CURE RATES FOR GENERAL PURPOSE RTV COMPOUNDS

(@ 77°F and 50% RH)

RTV Compound	0.1% Dibutyl Tin Dilaurate			0.5% Dibutyl Tin Dilaurate		
	Pot Life* (Hours)	Tack Free* Time (Hours)	Firm Time* (Hours)	Pot Life (Hours)	Tack Free Time (Hours)	Firm Time (Hours)
RTV-11	3-6	8-12	48	1-4	3-5	24
RTV-20	3-5	8-12	36	1-2	4-6	24+
RTV-21	3-5	5-10	24+	1-3	1-4	24
RTV-30	4-5	7-10	18-24	1-2	2-3	8-12
RTV-40	5-8	12-16	36-48	2-3	5-8	24+
RTV-41	3-6	5-10	24+	1-3	1-4	24
RTV-60	3-5	8-12	24+	1-3	3-6	24
RTV-77	2-3	5-10	36-48	1-3	3-4	24
RTV-88	4-6	8-12	24	1-2	4-6	16-24
RTV-90	½-1	2-3	18-24	<½	2-3	8-12

TYPICAL APPLICATION AND CURE CHARACTERISTICS FOR RTV-500 SERIES METHYL PHENYL COMPOUNDS

(@ 77°F and 50% RH)

	RTV-511		RTV-560		RTV-577		RTV-580	
Catalyst-Dibutyl-tin dilaurate @ weight percent	.2%	.5%	.2%	.5%	.2%	.5%	.2%	.5%
Application Time, Hrs. (15 gms/min Rate)	4-6	2-3	3-5	1-2	2-4	1-3	3-4	1-2
Pot Life, Hrs.	4-8	1-3	4-6	1-2	2-4	1-3	2-3	1-2
Tack Free Time, Hrs.	6-10	2-3½	5-8	1½-2½	3-5	2-4	2-4	1½-3
Firm Time, Hardness Shore "A"								
After 24 hours	30	40	45	50	42	45	50	50
48 hours	45	45	50	60	50	50	55	60
Flow (max.) inches	—	—	—	—	<.5	<.5	<.5	<.5
Weight Loss, % (on rubbers cured 1 week @ 77°F)	1.05	—	—	0.9	—	—	—	—

With 0.2-0.3% tin octoate, the above RTVs would have the following cure characteristics:

Pot Life	3-30 minutes
Tack Free Time	5-40 minutes
Firm Time	12-15 hours

* See "Definition of Terms".

DEFINITIONS OF TERMS

WORK LIFE (also called Pot Life, Application Life or Application Time) is the length of time between curing agent addition and cessation of compound flow. It is a measure of the time available to apply the material after curing agent has been added.

TACK FREE TIME is the time after which all surface tack is eliminated.

FIRM TIME is the time required to obtain about 40 Shore A durometer on a ½ inch thick sample.

Application Suggestions

AUTOMATED DISPENSING OF RTV COMPOUNDS

When RTV applications involve a steady rate of use, requiring assembly line operation, or catalysis of more than one gallon at a time, some degree of automation is highly desirable. Automation offers convenience, is more economical and provides for improved processing uniformity and cleaner housekeeping.

There can be considerable variation with respect to the degree of process automation required and its cost of installation. The conversion may be as simple as a change-can mixer and cartridge loaded shot dispenser or it may be as involved as a system that meters, mixes, deaerates, applies and indexes parts at such high speeds as 30-40 parts a minute per head. Application of mixed, deaerated, multiple component RTV through flexible hoses attached to a hand held mix head, at rates up to one gallon a minute, is also possible. A measured shot or continuous application of self curing adhesive from a 55 gallon reservoir (*viable* for several months after rigging and filling the pump) are other examples of what can be provided. Still more possibilities are application of as little as 0.20 g/shot ± 5% at 50 shots a minute, or use of an airless spray system to apply a 40 mil build-up on a large vertical surface in a single pass. It should be noted that, although the ratio of most liquid curing agents used with RTV is usually 1 to 200, machine systems work best with a paste curing agent ratio of 1 to 10 or similar ratios of an oil catalyst diluted with inert oil.

Full information on this method of application, including equipment currently available, can be obtained by requesting CDS-598.

ELIMINATING AIR BUBBLES AND VOIDS

In many applications, voids in the cured RTV would be extremely undesirable. Voids occur from air introduced into the compound and frequently result from (1) mixing RTV too rapidly, (2) pouring material too fast during application, and (3) applying too much heat to accelerate the cure.

To eliminate these voids, the material may be placed in a deaerator and subjected to a vacuum treatment, immediately after mixing. The time and pressure will depend upon the volume of RTV being evacuated and the viscosity of the RTV compound. A suggested procedure for 150 grams of RTV-21 is 5 to 15 minutes under a vacuum of 5 to 10 millimeters of mercury pressure. The same procedure may be followed with potted components or molded parts immediately after the RTV has been applied. Centrifuging may also be used to remove air bubbles from the mixed RTV compound.

CONTROLLING CURE TIMES AND TEMPERATURE

Cure characteristics of RTV compounds can be controlled by varying curing temperature as well as by the type and quantity of curing agent used. Low temperatures decrease the cure rate and increase the pot life. Higher temperatures accelerate the cure.

This permits considerable application flexibility. For example, after curing agent addition, RTV can be stored under refrigeration for several days if necessary. Then, after application, the RTV can be cured in a moderate-temperature oven in less than one hour.

INCREASING POT LIFE

In order to gain more working time after curing agent addition, the pot life may be increased by storing the RTV under refrigeration. See table below, "Effect of Low Temperatures on Pot Life".

ACCELERATING CURE RATES

Cure time can be reduced by curing in an oven or under a heat lamp. Effects of increased temperatures are shown below.

CURING IN CLOSED MOLDS

If an RTV part is cured in a closed mold, an additional air cure will be necessary to obtain maximum physical properties.

EFFECT OF LOW TEMPERATURES ON POT LIFE
(Time in Hours)

	Viscosity Doubled			Pot Life		
	23 C	-14 C	-30 C	23 C	-14 C	-30 C
RTV-20						
0.1% Dibutyl Tin Dilaurate	0.5	—	4	4	40	130
1.0% Dibutyl Tin Dilaurate	0.5	—	4	1	—	70
RTV-60						
0.1% Dibutyl Tin Dilaurate	—	4	15	4	25	100

EFFECT OF ELEVATED CURE TEMPERATURES

	Firm Time at Cure Temp. Of:		
	23°C	93°C	150°C
RTV-20			
0.1% Dibutyl Tin Dilaurate	30 hrs.	3 hrs.	50 min.
1.0% Dibutyl Tin Dilaurate	24 hrs.	1 hr.	40 min.
RTV-60			
0.1% Dibutyl Tin Dilaurate	24 hrs.	4 hrs.	2 hrs.

CURING THICK SECTIONS

When RTV is cured in a thickness of ¼ inch or greater, heat may be necessary to speed up the cure. If the product is to be used in service at over 300°F, the cured product should be temperature conditioned prior to service. A suggested program following room temperature cure of 1-3 days is eight hours at 50°F intervals from 200°F to service temperature. Longer times at each temperature will be required for larger parts.

Better results in curing thick sections will be obtained if lower curing agent concentrations are used. Thermolite-12 curing agent in concentrations of 0.1-0.3% is suggested.

Closed mold and thick section curing is accomplished for the RTV-600 series using the standard, recommended cure procedures for this group. (See pages 21-27).

COLORING RTV

The lighter colored RTV compounds — most particularly RTV-11, RTV-41 and RTV-77 — are easily colored as may be desired. The simplest procedure for accomplishing this is the addition of a small quantity of Silicone Paste Color Concentrate available from the Ferro Corporation, Color Division, 4150 East 56th Street, Cleveland 5, Ohio. The color paste may be mixed into the liquid rubber before or during the catalyst addition. The quantity of color paste to be used may vary from 0.5% or less up to possibly 5%, depending on the shade desired. Very little effect on cure rate or on final properties will result, but it is recommended that no more color paste be used than is needed to achieve the color tint desired.

The Ferro Silicone Paste Colors are inorganic pigments pre-ground in a suitable silicone oil. Following is a list of suitable paste colors as supplied by the Ferro Corporation:

V-1747 Black	V-2608 Green	V-1106 Red Brown
V-2876 Red	V-1936 Yellow	V-1107 Brown
V-1232 Blue	V-2658 Turquoise	V-1105 Buff

FACTORS AFFECTING SHRINKAGE

Linear shrinkage of 0.2 to 0.6 percent during cure can be expected with RTV compounds. This shrinkage is primarily due to the loss of volatile materials (curing agent and by-products of the cure reaction). Rapid curing at elevated temperatures may increase shrinkage to as much as 1.0 to 1.5 percent. Shrinkage is also influenced by the configuration of the molded piece — thick sections will shrink slightly less than thin sections. In order to keep shrinkage to a minimum, it is best to use the minimum acceptable curing agent level and to cure at room temperature.

Release Agents For Use With RTV Materials

RELEASING RTV FROM MOLDS

Where RTV materials are cured in molds, sticking may occur after repeated usage. The use of a mold release is suggested for such situations. For all RTV's, a 5% concentration of household detergent, such as Dreft, in water has proved satisfactory.

RELEASING PARTS FROM RTV MOLDS

For most applications, molds made of RTV naturally and easily release parts cast in epoxy or polyester resins — *with no release agent required.* However, after several releases from the RTV mold, by-products and catalyst systems of the casting resin may tend to attack the silicone rubber and cause sticking. Improving RTV mold life is possible using release agents such as polyethylene, etc.

Complete information on type and source of such mold release agents is available in TSR-1270 and TSR-1272.

Bonding

All of the RTV compounds described in this data book can be bonded to most metals, plastics, glass, etc. by using a suitable primer. When properly applied, this will result in bonds stronger than the rubber itself.(See pg. 16).

There are some materials to which RTV forms relatively poor bonds. These include natural and synthetic rubber (except silicone rubber), polyethylene, acrylics, and a number of flexible organic films. When working with these materials, bond strength should be checked to determine whether it is suitable for the application.

ADHESIVE/SEALANTS

For many sealing applications, the RTV adhesive/sealants which require no primer or curing agent will be easier to use than the two-package compounds described here. For more information, ask for Technical Data Book S-2.

BONDING PRIMERS AVAILABLE

SS-4004 PRIMER The bright, fluorescent pink color of SS-4004 makes it easy to determine whether a uniform coating has been applied. Fast drying solvents (acetone and isopropanol) in SS-4004 speed up its drying time, but these solvents are highly flammable and precautions must be taken to keep the primer away from fire or flame. The low flash point of SS-4004 prevents its being shipped by parcel post, except in sample quantities.

SS-4044 CLEAR PRIMER is a clear, colorless primer identical to SS-4004 except for the absence of the red color. The same solvents are employed and the same flammability precautions apply.

SS-4101 PRIMER is blue in color, available in handy aerosol cans for easy spray application as well as in bulk form for dipping or brushing.

BONDING PROCEDURE

All surfaces to be bonded should be thoroughly cleaned with a suitable solvent such as toluene, xylene, etc. Roughing up the surface with emery paper or sandblasting is not necessary.

SS-4004 or SS-4044 Primers are best applied by brushing or dipping. SS-4101 Primer may be brushed, dipped or sprayed — the spraying may be done by any convenient method, including the handy available aerosol cans. A uniform primer coat of approximately 0.5 to 1 mil in thickness usually provides the strongest bonds. When SS-4004 is used, the surface should be uniformly colored a light pink — *a dark red-pink color indicates too much primer; a light, almost colorless pink may indicate incomplete coverage.* The proper primer thickness, as indicated by color of the applied SS-4004 or SS-4101 primer, which will give the highest bond strength in a given application can easily be determined by trial and can then be reproduced in subsequent production operations.

Allow the primer to air dry for at least a half hour (an hour is better) before the RTV is applied. On porous surfaces a second coat of primer may be required; allow at least an hour drying time between coats.

Apply the RTV compound by laying it in place on the primed surface without severe rubbing which might disrupt the primer coating .

Bonding to cured silicone rubber surfaces (RTV or heat cured) generally does not require the use of a primer.

TYPICAL PROPERTIES — RTV SILICONE PRIMERS

Property	SS-4004	SS-4044	SS-4101
Color	Fluorescent Pink	Clear	Blue
Solids, % (45 min. @ 150°C)	15-18	15-18	15-18
Density (25°/4°C)	0.84-0.86	0.84-0.86	0.84-0.86
Dry Time, hrs.	<1	<1	1
Use With	General Purpose RTV's RTV-500 Series RTV-602	Same	Same

HANDLING PRECAUTIONS PRIMERS

All RTV primers should only be used in areas which have sufficient ventilation to remove solvent vapors. Persons should not breathe these vapors for prolonged periods.

STORAGE

SS-4004, SS-4044 and SS-4101 primers should be used within six months of receipt if maximum bond strength is desired. In storage, they should be kept sealed and placed in a cool, dark area.

A slight precipitation can be expected. This in no way way harms the product. Do not shake the bottle prior to use, but carefully decant the clear primer from the top of the bottle as needed.

RTV Clean Up And Removal Procedures

RTV CLEANUP (before curing)

Any solvent may be used although hydrocarbons like trichloroethylene or aromatic hydrocarbons like xylene are somewhat more effective. A relatively good solvent consists of 70% carbon tetrachloride and 30% hexane. Another good solvent is a volumetric blend of 10 parts isopropanol, 20 parts methyl ethyl ketone, 20 parts isopropyl acetate, 50 parts N-3 Naphtha from Fischer Scientific (aromatic petroleum naphtha). Solvent toxicity should be investigated, especially with carbon tetrachloride.

REMOVING RTV AFTER BONDING

Removing RTV which has been bonded to metal, plastic or glass surfaces is simplified by immersion in a suitable stripping solution, such as Diverstrip* WS-1 and related additives from Diverstrip Corporation, 212 W. Monroe St., Chicago, Illinois.

Another good solvent is Ordcostrip** #1 from Oreland Research Company, 4041 Ridge Ave., Philadelphia 29, Pa. Both of these systems are water soluble organic acid or alkaline solvent blends and excessive skin contact or vapor inhalations must be avoided.

Aromatic solvents like toluene or xylene and chlorinated solvents like trichloroethylene will swell the cured rubber and soften it temporarily to facilitate mechanical removal.

* T.M., Diverstrip Corp.
** T.M., Oreland Research Co.

Hot solvent should be faster and more effective. Bonded parts are often best cleaned with a combination of something to swell the rubber first and then acetone to soften the primer bond.

Silicone rubber is chemically attacked by concentrated sulfuric or other mineral acids. It is also liquefied by exposure for several days to high pressure open steam. Phenol or dimethyl formamide are fair solvents.

Selection of the swelling solvent or chemical treatment should be based on the substrate concerned and safety precautions necessary in the handling area. The following table summarizes solution effects.

IMMERSION FLUID	Acetone or Alcohol	Aliphatic Hydro-carbons	Halogenated HC or Aromatics	H_2SO_4 or Phenol	Caustic or Dimethyl Formamide	High Pressure Open Steam 30 psi
EFFECT	Exposed primer bond softened	10 to 20% swell	20 to 100% swell	Partial solution	Partial solution	Slow liquification

Lowering Viscosity with RTV Diluents

For General Purpose and 500 Series Compounds

For some applications it is desirable to lower the viscosity of the general purpose and RTV - 500 series silicone rubber compounds to obtain better flow. RTV-910 and RTV-911 diluents are dimethyl silicone fluids intended to be used for this purpose. Although RTV-910 and RTV-911 diluents are effective in lowering viscosity of uncured RTV silicone rubber compounds, this is accomplished only with some slowing of curing rate and sacrifice of final cured properties of the rubber. Slower cure rate can be compensated for by use of increased concentration of curing agent. Although physical properties are adversely affected, electrical properties are not.

TYPICAL PROPERTIES — RTV DILUENTS

	RTV-910	RTV-911
Appearance	Clear, Colorless	
Viscosity, centistokes, ±5% (at 25°C)	50	500
Specific Gravity (25°C/25°C)	0.96	0.97
Pour Point	-60°F	
Flash Point	Above 600°F	
Volatility (% Wt. loss, 24 hrs. at 150°C)	0.5% max.	

USE OF RTV DILUENTS

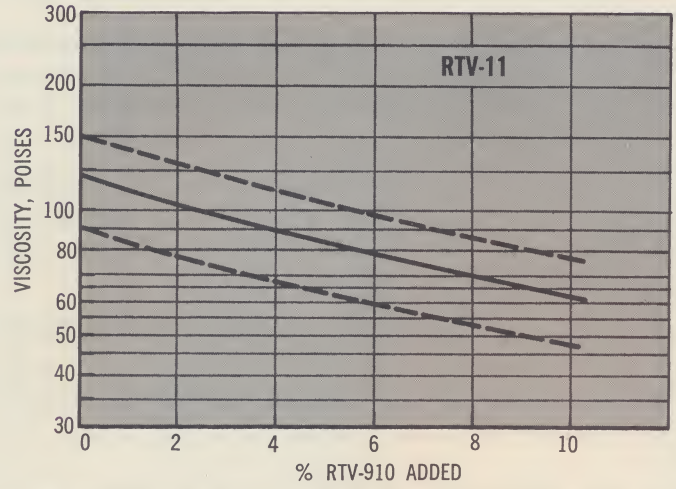
QUANTITIES TO USE

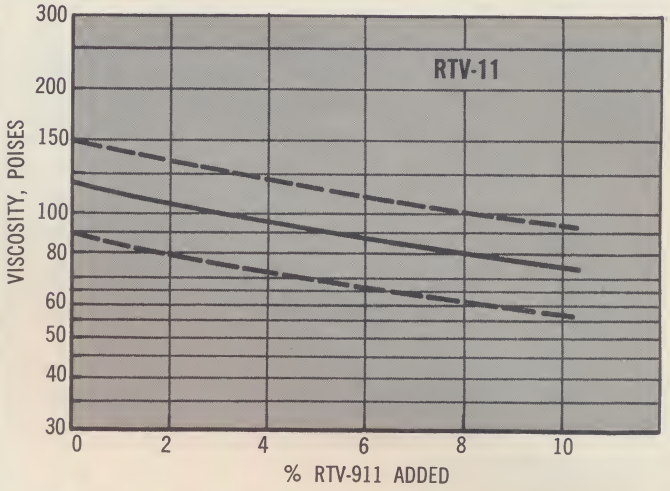
It is suggested that, wherever possible, diluent additions be limited to 5% of the weight of the RTV compound. The maximum recommended quantity is 10% by weight. Beyond this point reliability of cure and performance cannot be depended upon.

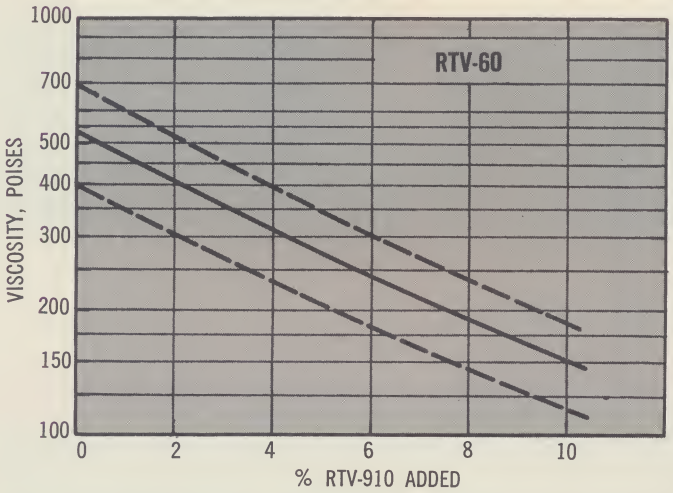
EFFECT ON VISCOSITY

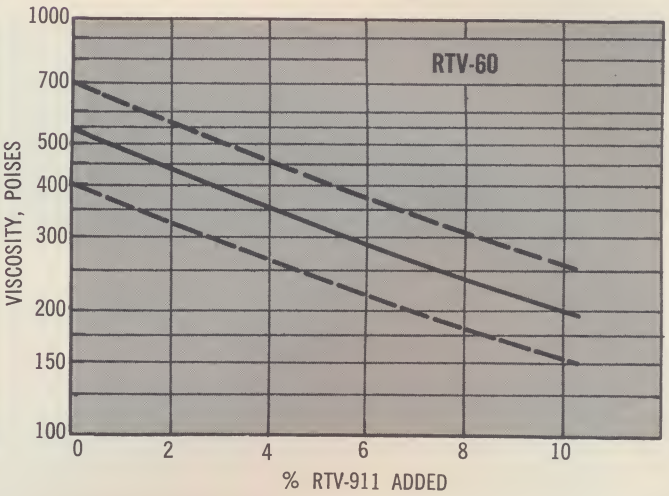
The effectiveness of these diluents on reduction of the viscosity of RTV-11 and RTV-60 liquid silicone rubber compounds is shown in the accompanying graphs. Viscosity measurements are taken on uncatalyzed compounds at room temperature, using a Brookfield RVF Viscometer, with a No. 6 spindle at 10 rpm.

EFFECT OF DILUENT ADDITION ON VISCOSITY OF RTV COMPOUNDS





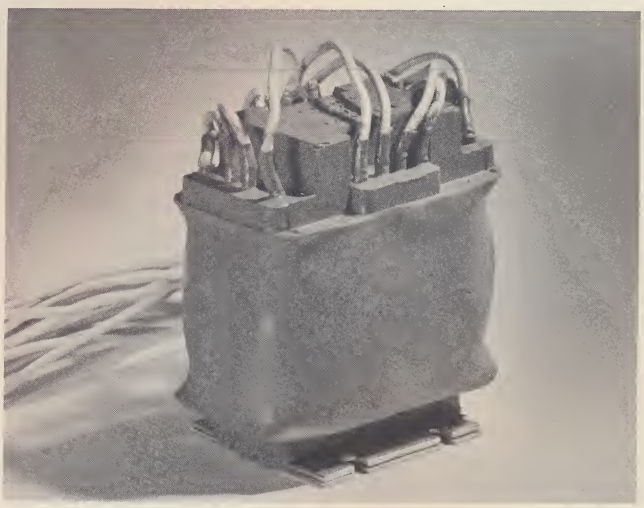




EFFECT ON CURE RATE

The addition of silicone oil diluents has a tendency to slow down the room temperature cure rate of RTV compounds. As a rule of thumb, the addition of 5% diluent will increase pot life up to about 50%, while 10% oil addition may nearly double it. Total cure time is affected to a lesser degree. To compensate for the slower cure rate, a somewhat higher concentration of curing agent may be used.

Most satisfactory cures of RTV compounds containing silicone fluid diluent are obtained at room temperature. To accelerate the cure, or to prepare cured material for service at temperatures of 300° to 600°F, heat may be applied. However, application of heat must be made slowly to prevent blowing of the cured rubber, particularly in sections over a quarter inch in thickness. It is recommended that sections up to one-half inch thick be allowed to cure for 24 to 72 hours before heating, and that the temperature then be raised in increments of 50°F for 24 hour periods, starting at 150°F, until the service temperature is reached.



For applications, such as impregnating aircraft transformers, where viscosities lower than those available are desired, RTV diluents may be used to lower the viscosity of standard RTV compounds.

EFFECT ON CURED PHYSICAL PROPERTIES

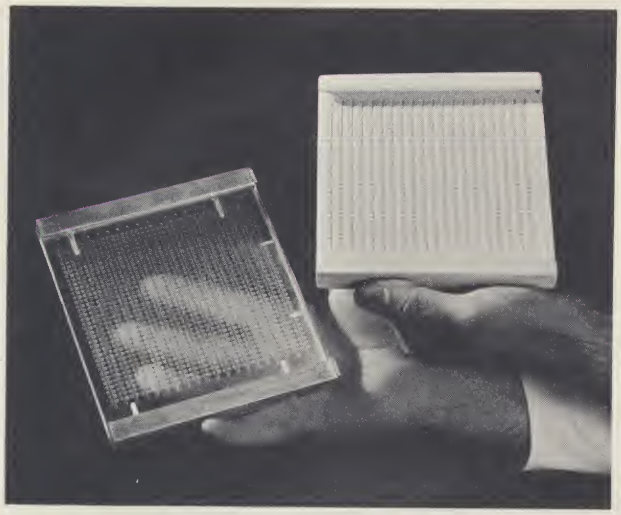
In the quantities recommended, the addition of RTV-910 and RTV-911 diluents causes an appreciable but not severe lowering of durometer hardness and tensile strength. Ultimate elongation is affected very little. The properties shown in the table on page 19 are typical.

EFFECT ON ELECTRICAL PROPERTIES

The electrical properties of these silicone fluids are excellent. They have no deleterious effect on the electrical properties of RTV silicone rubber to which they may be added.

STORAGE AND HANDLING

RTV diluents should be kept in clean, covered containers, free from contamination. Storage temperature is not significant with these materials. Shelf life is indefinite.



Lower viscosities are desirable when making RTV molds to reproduce very fine detail. However, the use of diluents will lower the physical properties of the cured rubber which may reduce the useful life of the mold.

EFFECT OF DILUENTS ON PHYSICAL PROPERTIES OF CURED (RTV-60, 0.3% Dibutyl Tin Dilaurate)

	No Oil Added	5% RTV-910	10% RTV-910	5% RTV-911	10% RTV-911
RTV-60 cured 7 days at 75°F					
Shore A Hardness	63	58	51	59	52
Tensile Strength, psi	860	750	630	770	660
Elongation, %	135	145	140	120	100
Tear Resistance, Die B, lb/in.	44	37	32	38	29
RTV-60 cured 3 days at 75°F plus 3 days at 400°F					
Shore A Hardness	50	52	45	52	44
Tensile Strength, psi	760	635	500	610	535
Elongation, %	135	165	145	140	140
% Weight Loss, 6 hrs/480°F	1.7	2.1	2.3	1.8	2.1

Applying RTV Silicone Rubber by Spray

The spray coating technique is one of the fastest, easiest, and most economical methods for applying relatively thin films of protective coatings and mold release materials.

Many of the applications for the Room Temperature Curing Silicone Rubber Compounds (RTV) require that these compounds be applied in thin films for encapsulation, protective coating or mold release purposes. The techniques of spray coating would be extremely attractive for applying the RTV silicone rubber compounds in many applications for reasons of economy, speed and improved product appearance. This technique is also attractive as a method to overcome pot-life problems in mass production operations.

A few examples of the many potential application areas where spraying of the RTV silicone rubber compounds could offer many benefits in both improved product quality and economies of application are:

MAKING RTV MOLDS. An initial spraying of the master pattern assures good penetration into minute surface details to provide accurate reproduction.

ENCAPSULATION. A conformal protective coating of RTV can be applied to electronic components by spraying. This method is quick, economical and helps eliminate pot-life problems.

RELEASE AND PROTECTIVE COATINGS. Large areas where release coatings are required, such as conveyor belts, trays, etc., can easily be coated by spraying. Protective coatings on industrial pipes, fixtures and instruments exposed to corrosive atmospheres can also be provided by an RTV spray.

THERMAL INSULATION. The high-temperature resistance of silicone rubber makes it effective as a thermal barrier to protect surfaces from intense heat and flame. One or more spray coatings of RTV can be an effective method of providing such protection.

Certain RTV compounds can be sprayed, after being diluted with mineral spirits or an equivalent solvent, with commercial pressure-feed or siphon-feed spray equipment. When diluting RTV compounds, 30-40% solvent addition usually gives good results with most compounds. Approximately 40 pounds atomization air pressure to the spray heads of either pressure or siphon-feed guns is suggested. With a pressure-feed gun, use 30-40 pounds material air pressure to the pressurized feed tank or cup.

The dilute RTV compound may be stored, and cured immediately prior to use. Another technique, that eliminates pot-life problems, is to spray uncatalyzed RTV and then overspray with curing agent (as described under RTV aerosol below). The curing agent, either dibutyl tin dilaurate or tin octoate, should be diluted with 20-50% by weight of mineral spirits or a similar solvent.

For more detailed instructions in the use of spray techniques with RTV compounds, ask for TSR-1714.

RTV-60 AEROSOL

RTV-60 is available in aerosol packages to provide a convenient method of RTV spray coating in thin films. Dibutyl tin dilaurate and tin octoate curing agents are also available in separate aerosol and are used as an overspray to cure the RTV-60. Since it is in the developmental stage, specifications are subject to change. Future availability is contingent on industry's confirmation of the usefulness of the material.

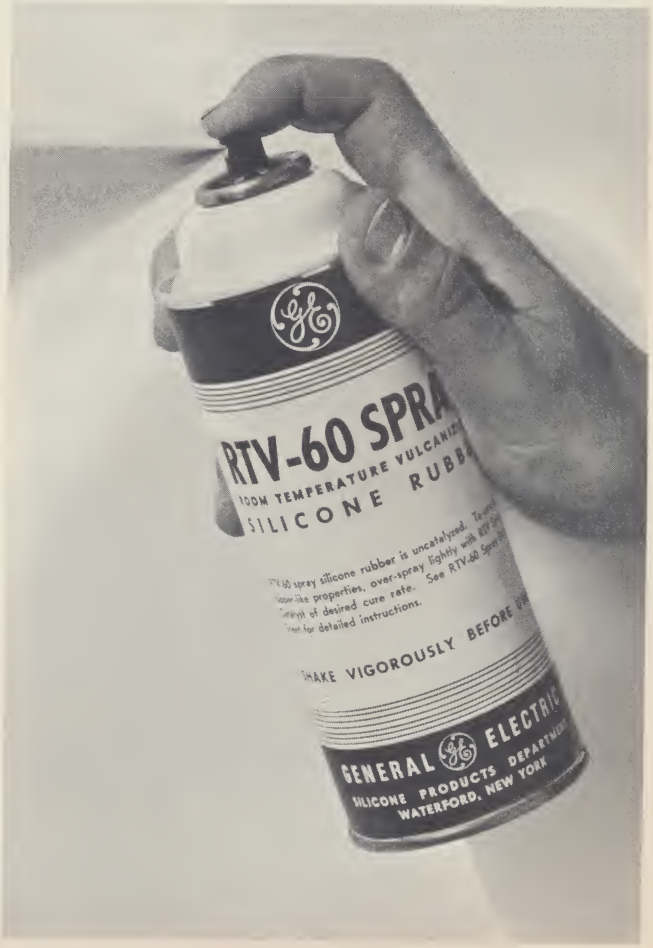
The RTV-60 aerosol spray will deliver approximately 12 grams of RTV-60 per minute. Eighteen square inches of flat surface can be coated to a depth of three mils in three uniform five-second passes. One 16-ounce aerosol can of RTV-60 will provide a uniform coating four mils thick over a flat surface area of 2,000 square inches.

Eighteen square inches of a four-mil coating of RTV-60 can be cured by a uniform curing agent spray of about four seconds duration. At this rate, one 6-ounce can of RTV curing agent will spray about 2,700 square inches.

Shelf life of RTV-60 spray and the RTV Curing Agent Spray is at least six months. Full information on application procedures and precautionary measures are provided on the RTV-60 Spray can.

CURE TIMES — RTV-60 SPRAY (18 sq. in. coating 4 mil thick)

Catalyst	Spray Time	Gel-Point	Tack-Free Time
Dibutyl Tin Dilaurate (Thermolite-12)	3 sec.	90 min.	180 min.
Tin Octoate (Silicure T-773)	3 sec.	45 min.	75 min.
Tin Octoate (Silicure T-773)	5 sec.	15 min.	25 min.



Storage of RTV Products

All RTV compounds should be kept during storage in clean, covered containers at the lowest possible temperature (not above 80°F for extended periods).

The shelf life of RTV compounds will be in excess of the times indicated in the following table. Each package of General Electric RTV compound is stamped with a warranty expiration date and it is advisable to use the material before this date, although the useful shelf life should be somewhat longer. If material is used considerably later than the expiration date, it is advisable to test a small quantity to be sure that a proper cure can still be obtained. All curing agents exhibit shelf life equivalent to their respective products listed right.

PRODUCT	STORAGE LIFE FROM DATE OF SHIPMENT IS IN EXCESS OF:
RTV-11	6 months
RTV-20	3 months
RTV-21	6 months
RTV-30	4 months
RTV-40	3 months
RTV-41	6 months
RTV-60	4 months
RTV-77	4 months
RTV-88	3 months
RTV-90	6 months
RTV-511	6 months
RTV-560	4 months
RTV-577	4 months
RTV-580	3 months

TOXICITY

RTV compounds are non-toxic and completely safe to handle. (However, care should be taken in handling curing agents and primers.)

Cured RTV silicone rubber may be used for food handling applications, under regulations published by the Food and Drug Administration, when cured with tin oleate or dibutyl tin dilaurate. Parts cured with more than 0.25% dibutyl tin dilaurate should be given a heat treatment at 300°F overnight to volatize excess catalyst.

Fast Curing, Low Viscosity RTV Potting Compounds

Silicone rubber compounds in the RTV-600 series were developed to meet specific requirements of the electrical and electronics industry. Available in both opaque and transparent liquid form, they are used for potting and encapsulating applications, and provide thick section closed-mold curing characteristics required by this industry. They offer excellent environmental protection wherever they are used.

RTV-602 LOW VISCOSITY TRANSPARENT SILICONE POTTING COMPOUNDS (formerly identified as LTV-602)

General Electric RTV-602 is a low viscosity transparent compound that cures with the addition of a catalyst to form a completely transparent, resilient solid. It provides excellent environmental protection and the ability to easily identify and repair protected components. It permits easy component identification, repair and replacement. RTV-602 can be cured rapidly, within 2 hours at 65°C (150°F), and in less than 24 hours at room temperature. An easily pourable liquid, RTV-602 has a viscosity of 12 poises (1200 cps).

PROPERTIES OF RTV-602

PROPERTIES SHOWN HERE SHOULD NOT BE USED IN PREPARING SPECIFICATIONS.

Assistance and recommendations can be obtained by contacting the Silicone Products Department, General Electric Company, Waterford, New York.

TYPICAL UNCURED PHYSICAL PROPERTIES	
Color	Clear
Viscosity @ 25°C	800-1500 centipoise
Consistency	Easily pourable
Solids Content, %	100
Specific Gravity @ 25°C	0.995
Uncatalyzed Shelf Life @ 25°C	3 months
Refractive Index	1.406
Shelf Life @ 25°C	6 months min.

TYPICAL CURED PHYSICAL PROPERTIES	
Color	Clear, colorless
Specific Gravity @ 25°C	0.995
Thermal Conductivity (BTU/hr. Sq. Ft., °F/Ft @ 120°F)	0.10
Specific Heat (BTU/lb./°F)	0.36-0.37
Temperature Effect on Volume (avg.) (cc/°C, 25-150°C)	10.55×10^{-4}
Refractive Index	1.406
Durometer Shore A,	15

TYPICAL ELECTRICAL PROPERTIES*

Dielectric Strength

(ASTM Method D-176, 60 cycle, 1000 volts per sec. rise, 0.5 inch spherical electrodes)	
.020" spacing	41 Kv
.100" spacing	75 Kv

Dielectric Constant

	25C 50% RH	After 96 hrs. @ 96% RH
100 cps.	3.0	3.0
1 KC	3.0	3.0
10 KC	3.0	3.0
100 KC	3.0	3.0

Dissipation Factor

100 cps.	.0012	.001
1 KC	.0012	.0008
10 KC	.0012	.0009
100 KC	.0012	.001

Volume Resistivity, ohm-cm 1×10^{14}

* For optimum electrical properties, it is recommended that the component to be potted be primed with SS-4004 or SS-4044 (see pg. 16).

ELECTRICAL PROPERTIES

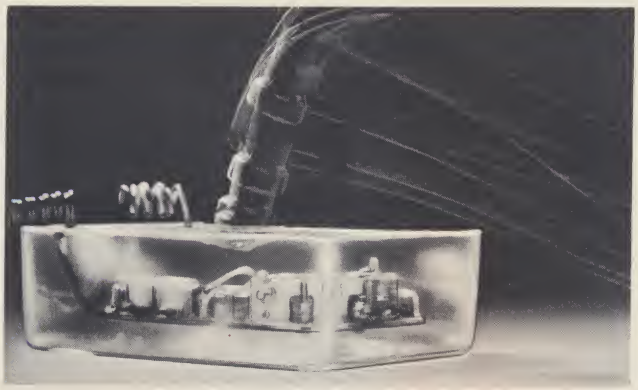
RTV-602 offers outstanding electrical properties superior to those of conventional potting compounds. These properties are essentially constant over a wide range of frequency as shown in the table of "Typical Electric Properties". Dielectric constant and dissipation factor shown here were measured with a 78 mmfd. fixed air capacitor, Cardwell type ER-75-FS, according to ASTM D-150. Volume resistivity was measured with the same capacitor electrode system, according to ASTM D-257 Method.

RESISTANCE TO THERMAL SHOCK

RTV-602 is designed to meet thermal shock requirements of MIL-STD-202A, test condition B, (five temperature cycles from −65°C to 125°C). RTV shows essentially no changes in physical properties after exposure. Volume resistivity measurements before and after testing show no change in volume resistivity for both primed and unprimed capacitors after completion of the five cycles.

RESISTANCE TO MOISTURE AND WATER IMMERSION

RTV-602 offers excellent resistance to moisture and to complete water immersion as indicated in the volume resistivity data that follows.



VOLUME RESISTIVITY OF RTV-602
(ohm-cm)

Conditioning	Volume Resistivity
25°C 50% RH	2.8×10^{13}
96 hrs @ 96% RH	2.2×10^{13}
Water Immersion (tap water)	
15 minutes	3×10^{13}
40 hrs	2×10^{13}

RESILIENCY OF RTV-602 offers excellent shock resistance. Although firm enough to resist shock and vibration, this material permits easy repair.

THERMAL STABILITY

Thermal stability of RTV-602 is excellent with high temperature aging increasing the firmness of the material but not affecting its electrical properties or degree of protection. After extended periods of heat aging, RTV-602 remains transparent but may show signs of slight amber-ing. It will, however, eventually return to its original color.

RTV-602 will provide protection for continuous operation at 150°C, (302°F), over 3000 hours at 175°C (347°F), and 1000 or more at 200°C, (392°F). RTV-602 exhibits low weight loss after extended heat aging as shown in the table below. These tests were made in air. The thermal life of RTV-602 can be extended in an inert atmosphere or in an oxygen-free atmosphere.

WEIGHT LOSS VS. HEAT AGING RTV-602

Temperature	Weight Loss (after 1800 hours)
105°C	1.75%
150°C	2.4 %
175°C	3.3 %

COMPATIBILITY

Laboratory tests show RTV-602 to be compatible with most insulating materials used in electronic assemblies, including: SILICONE RESINS, ALKENEX* WIRE, FORMEX WIRE, BLACK VARNISHED RAG PAPER, EPOXY GLASS, MYLAR**, KRAFT PAPER, ASBESTOS WITH STARCH BINDER AND POLYESTER ASBESTOS. RTV-602 is also compatible with SILICONE RUBBER, INCLUDING THE RTV COMPOUNDS. Uncured phenolics and shellac have shown questionable compatibility in laboratory tests. Low melting wax coated components may be potted, however, the transparency of RTV-602 will be reduced unless it is cured at room temperature.

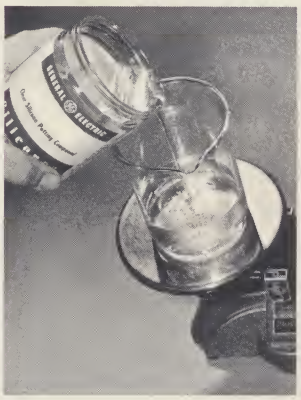
Priming of components prior to potting usually eliminates any problems of compatibility. General Electric offers two available primers, identified as SS-4004 and SS-4044 that are recommended for RTV-602 and the complete line of RTV silicone rubbers. Both primers are described in detail on page 16.

* Registered trademark, General Electric Co.

** Registered trademark, E. I. duPont, Inc.

How To Use General Electric RTV-602

RTV-602 is easily prepared and applied. Having a low viscosity in the uncured state, RTV is easily poured and flows freely in-and-around intricate parts.



1. PLACE SUFFICIENT RTV-602 for your application

into a container — cardboard will do — for weighing and mixing. RTV-602 should first be weighed to determine the correct amount of curing agent to be added (see step 2). After mixing, RTV-602 must be deaerated (see step 3). Since deaeration increases the volume of RTV initially, the container should be filled to no more than one-third of its capacity. For controlled cure rates, weigh RTV-602 on a triple beam balance or equivalent-type scale. Otherwise, the amount of RTV need only be estimated.

2. MEASURE CATALYST.

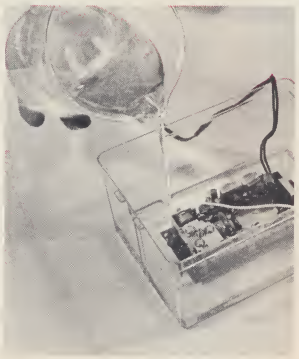
After weighing RTV, add sufficient catalyst. If a long pot life, or working time, is required SRC-04 catalyst is recommended. For an extra fast cure or for a room temperature cure use SRC-05 catalyst. The table below provides an easy guide for measuring the correct amount of catalyst. More detailed information on the type and amount of catalyst to be used appears under "Controlling Cure Times".

3. MIXING, DEAERATING AND POURING.

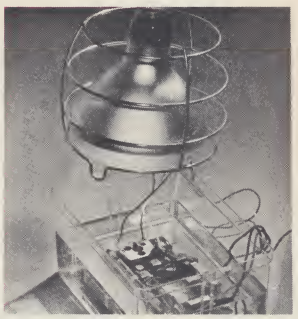
Thoroughly mix the measured catalyst with the RTV, using a clean glass rod or spatula. Immediately after mixing, air must be removed to prevent air bubbles and voids in the cured compound. This can be done by deaerating the mixture under vacuum using low cost equipment.*

For complicated and complex components, it is suggested that the catalyzed RTV be deaerated and poured under vacuum into the unit being potted. For open-type components and assemblies that are freely vented, deaerating the mixed RTV, pouring at atmospheric pressure, and then again deaerating the complete potted unit, provides a void-free structure. If the component or assembly being potted is a very simple design, an initial deaeration immediately after mixing may be all that is necessary.

*Available from Fisher Scientific Company, 633 Greenwich Street, New York. Refer to Fisher vacuum desiccator (catalog #8-631) and Fisher 9-956 Airejector.

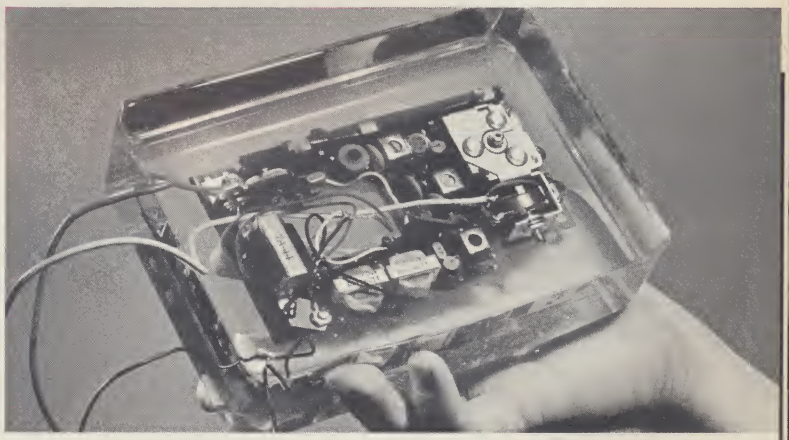


When deaerating RTV-602, a reduction of pressure to 20 mm or below is usually adequate to remove air. For intricate structures, a reduction of pressure to 1 mm may be required to eliminate all voids. For best results during deaerating, it may be necessary to "bump" or raise and lower the pressure a number of times to break any bubbles that may have formed. When using SRC-05 catalyst keep the vacuum period to a minimum in accordance with the pot life of the catalyzed material.



4. CURING.

After potting and removing entrapped air, the complete unit is ready for cure. Although RTV-602 is normally cured at low temperatures (60-100°C), it can also be cured at room temperature. Type of cure will depend upon your specific application requirements. (For more detailed information, refer to the following section on "Controlling Cure Times").



MEASURING GUIDE*

WEIGHT OF RTV-602		AMOUNT OF CATALYST					
		SRC-05 0.25%		SRC-04 or SRC-05 0.50%		SRC-04 1.00%	
Grams	Oz.	Grams	Drops**	Grams	Drops**	Grams	Drops**
20	—	0.05	2	0.10	4	0.20	8
57	2	0.14	6	0.29	12	0.57	23
100	—	0.25	10	0.50	20	1.00	40
113	4	0.28	11	0.57	23	1.13	46
200	—	0.50	20	1.00	40	2.00	80
227	8	0.57	23	1.14	46	2.27	91
454	16	1.14	46	2.27	91	4.54	182

* This is to serve as a guide only. Other catalyst levels may be determined by experiment as being more suitable for specific applications.

** Approximate number of drops using medicine dropper.

CONTROLLING CURE TIMES

Cure characteristics of RTV-602 can be controlled by (1) type of curing agent or catalyst used; (2) quantity of catalyst used, and (3) temperature during cure.

CATALYST SELECTION

Two catalysts are available:

SRC-04: Used when longer pot life* is required — provides slow cure.

SRC-05: Gives fast cure with corresponding reduction in pot life.

The table below shows the effect of varying type and quantity of catalyst.

* Pot life here defined as the length fo time between catalyst addition and cessation of easy pourability.

ACCELERATING CURE RATES

A typical curing temperature for RTV-602 is 65°C in an oven or with a heat lamp. Cure times at this temperature are shown below. Curing time may be significantly reduced by increasing the curing temperature up to 125°C.

POST CURING

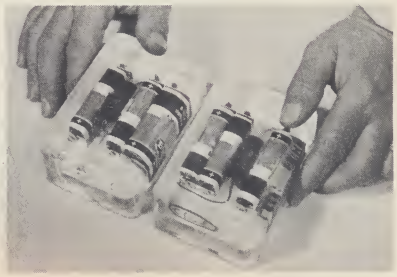
To minimize weight loss for operation at elevated temperatures the compound may be post cured at 100°C (212°F) for 1 to 6 hours, depending upon volume of material, equipment size, etc.

REPAIRING POTTED COMPONENTS

RTV-602 is unique in being completely transparent and curing to a solid, yet flexible material. As a result, it is the ideal potting compound for identifying, repairing and replacing components. Because in-place repairs are frequently required, room temperature curing with SRC-05 catalyst is usually desirable. If any part of the potted assembly or component needs to be repaired or replaced, merely:

1. REMOVE SECTION OF MATERIAL. RTV-602 is firm enough for good mechanical support, yet can be easily cut-through with a knife.

2. ADD MORE RTV. After a part of RTV has been removed, and the defective part replaced or repaired, merely pour freshly catalyzed material into the cut-out section, and fill to original level.



3. CURES CLEAR. RTV-602 cures completely clear with no evidence of repair. For example, compare repaired unit at left with original version at right.

EFFECT OF CATALYST TYPE AND CONCENTRATION ON RTV-602

SRC-05 Catalyst Level	Pot Life	Cure at 65°C (150°F)	Cure at Room Temperature
0.25%	2-3 hours	5 hours	24-36 hours
0.50%	20-30 min.	2 hours	Less than 24 hours
SRC-04 Catalyst Level	**Pot Life**	**Cure at 80°C (176°)**	**Cure at Room Temperature**
0.50%	8 hours	8-16 hrs.	Recommend
1.00%	8 hours	5-8 hours	SRC-05 Curing Agent

BONDING

RTV-602 can be bonded to various components and materials used in electronic assemblies using the same primers and procedures as used for the general purpose RTV's. Refer to page 16.

Releasing RTV-602 from Molds

When removing cured RTV from a mold or container, it is recommended that a separate release agent be used.

A 30% solution of Tetronic 701*, in Trichlorethylene wiped on the surface of the mold or container prior to potting will provide easy release. A 5% concentration of a household detergent such as Dreft** in water has also proved satisfactory.

*Tetronic 701 may be purchased from Wyandotte Chemical Company, Wyandotte, Michigan.

* T.M.,Wyandotte Chemical Co.
** Reg. T.M., Proctor and Gamble Co.

STORAGE AND HANDLING

STORAGE OF RTV-602

RTV-602 is solventless and non-toxic. It should be stored in clean, covered containers at the lowest possible temperature (not above 80°F) for extended periods. When practical, the material should be stored under refrigeration.

HANDLING PRECAUTIONS—CATALYSTS

Both SRC-04 and SRC-05 are alkalies similar to catalysts used for many epoxies. Contact with the skin can cause a burn. Take suitable safety precautions and exercise care in handling to avoid contact with clothing, skin or eyes. If skin contact occurs, wash immediately with soap and water. Treat as a burn. If catalyst enters eyes, immediately wash with water and consult a physician.

RTV-615 & -616 CLEAR & OPAQUE POTTING COMPOUNDS

General Electric RTV-615 and RTV-616 are low viscosity silicone liquids that cure at room temperature, after the addition of a curing agent, to form a rubber-like, tough, potting compound. Compared with previously available clear potting compounds, RTV-615 offers improved physical properties as well as a faster cure system, suitable for production line use. RTV-616 has similar properties and is an opaque black compound. As with other silicone elastomers, RTV-615 and RTV-616 offer protection against ozone, corona and many harmful contaminants.

Easy Handling

Measuring is simplified since the curing agent is always added to base polymer in a straight "1 to 10" part ratio.

Low Viscosity

RTV-615 has a typical viscosity of 3500 centipoises, RTV-616, 4000 centipoises. Both are easily pourable and flow in and around intricate electronic assemblies.

Toughness

Physical properties of RTV-615 are maintained from −65°C to 200°C providing a durable, resilient protective coating. RTV-616 is useful to 250°C.

Excellent Electrical Properties

Low dielectric loss properties, high dielectric strength.

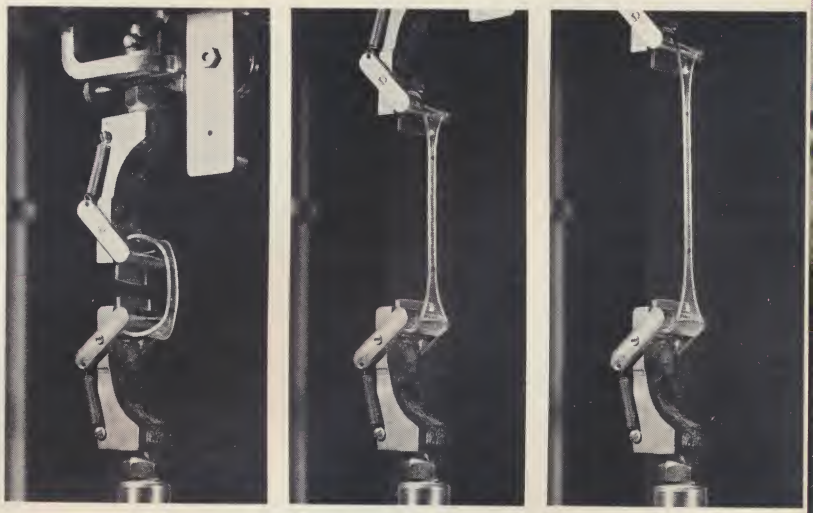
PROPERTIES SHOWN HERE SHOULD NOT BE USED IN PREPARING SPECIFICATIONS.

Fast Cure

Well suited for production line use, these materials can be cured within 15-30 minutes at 150°C or at a longer time at room temperature.

Cures in Absence of Air

Both RTV-615 and RTV-616 will cure in deep sections and in completely enclosed assemblies without exotherm and without damaging stresses on potted assemblies.



HIGH STRENGTH OF RTV-615 demonstrated in standard laboratory test. At upper left, RTV sample in original state prior to test. During test, RTV-615 withstands elongation up to 150% and demonstrates tensile strength up to 1,000 psi.

TYPICAL UNCURED PROPERTIES

	RTV-615	RTV-616
Color	Clear — Light Straw	Black — Opaque
Viscosity at 25°C	3500 centipoise	4000 centipoise
Consistency	Easily Pourable	Easily Pourable
Solids Content (Nominal)	100%	100%
Specific Gravity at 25°C	1.02	1.23
Shelf Life at 25°C	6 months minimum	6 months minimum
Pot Life at 25°C (with curing agent added)	4 hours	4 hours
Refractive Index	1.406	-------

TYPICAL CURED PROPERTIES

(Cured 4 hours at 65°C)	RTV-615	RTV-616
Color	Transparent, Clear	Black — Opaque
Specific Gravity	1.02	1.22
ASTM-D 676 Durometer Shore A	35	45
Thermal conductivity	Greater than 0.10 BTU/°F. ft. hr.	
Temperature Effect on Volume	Less than 1% volume increase per 10°C	
Tensile Strength	800-1,000 psi	
Elongation	100-150%	
Weight Loss*, % after 1000 hrs. at 200°C	Less than 3.0	
Shelf life at 25°C	6 months minimum	

* Tested on 2 inch diameter specimen, one-half inch thick.

TYPICAL ELECTRICAL PROPERTIES

	RTV-615 and RTV-616
Dielectric Strength** — ASTM D-149	500 volts/mil
Dielectric Constant — ASTM D-150, 10^3 cycles	3.0
Dissipation Factor — ASTM D-150, 10^3 cycles	.001-.010
Volume Resistivity ASTM D-257	1×10^{14}

** Tested on 0.064 inch thick specimen, using 1 inch electrode, in oil, 500 volt/sec. rise.

RESISTANCE TO THERMAL SHOCK

RTV-615 and RTV-616 are designed to meet thermal shock requirements as outlined in MIL-STD-202A, test condition B, (five temperature cycles from −65°C to 125°C). They show essentially no changes in physical properties after exposure. Volume resistivity measurements before and after testing show no change in volume resistivity for both primed and unprimed capacitors after completion of the five cycles.

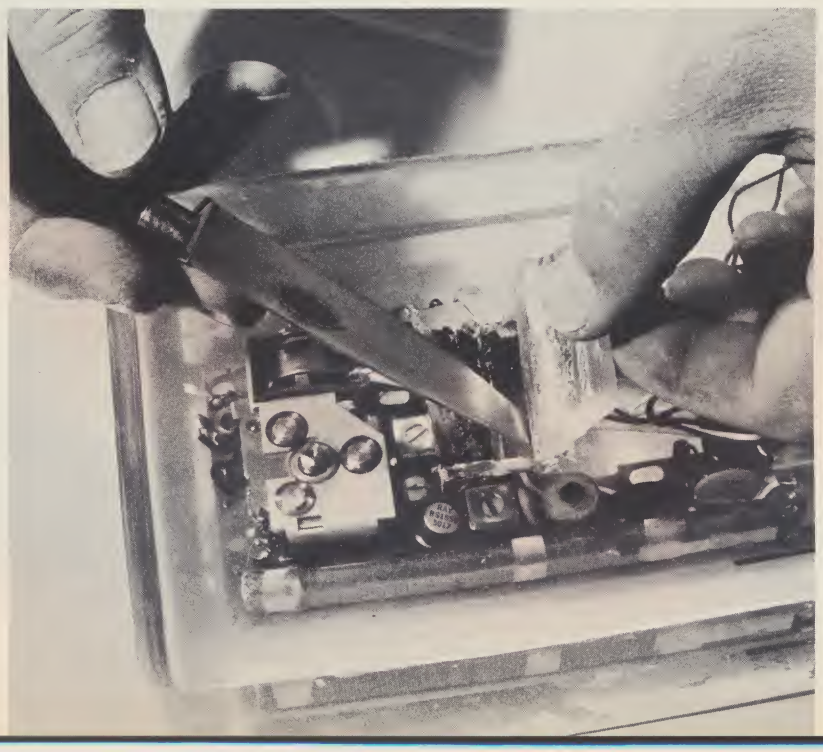
RESISTANCE TO MOISTURE AND WATER IMMERSION

Both RTV-615 and RTV-616 offer excellent resistance to moisture and to complete water immersion as indicated in the volume resistivity data that follows:

VOLUME RESISTIVITY (ohm-cm)

Conditioning	Volume Resistivity
25°C 50% R.H.	2.1×10^{15}
96 hrs. at 96% R.H.	2.1×10^{15}
Water Immersion (tap water)	
15 minutes	3.2×10^{15}
40 hrs.	3.4×10^{15}

RTV-615 can be easily cut-through to repair or replace defective components.



How To Use General Electric RTV-615 and RTV-616

NOTE: RTV-615 and RTV-616 are provided as two package systems. The compound is identified as the "A" portion, and the curing agent is identified as the "B" portion. Curing is accomplished by mixing the curing agent RTV-615B into the RTV-615A compound or in the case of RTV-616, by mixing the RTV-616B into the RTV-616A compound. The procedure outlined below for RTV-616 also applies to RTV-615 except, of course, the RTV-615A and RTV-615B materials are used.

1. Use only clean containers for weighing and mixing. Weigh the RTV-616A, filling the container only about one-third full to allow room for deaeration, and for mixing. To assure uniform mixing, if mixing is done by hand, it is suggested that the material be poured from one container to another, at least once, during the mixing operation.

2. To the RTV-616A, add 1 part by weight of RTV-616B per 10 parts of RTV-616A. The ratio of curing agent RTV-616B to RTV-616A compound is important. The amount of curing agent should be held within ±10 percent of the specified amount. Addition of excess curing agent will tend to increase the hardness and decrease the elongation of the cured material. Excess curing agent will also degrade the heat aging properties of the compound.

3. Thoroughly mix the measured amount of curing agent with the RTV-616A, using a clean glass rod or spatula. Transfer the mixture from one container to another at least once during the mixing to assure uniform mixing throughout. Immediately after mixing, air must be removed to prevent bubbles and voids. This can be done by deaerating the mixture under vacuum. When deaerating RTV-616, a reduction of pressure to 20 mm. or below for 15 to 20 minutes is usually adequate to remove air. For best results, during deaerating, it may be necessary to "bump" or raise and lower the pressure a number of times to break any bubbles that form. When pouring RTV-616 into the potting container, care should be taken to minimize entrapped air. For complicated and complex assemblies, it is suggested that pouring be done under vacuum. If this cannot be done, the potted unit should be deaerated immediately after pouring.

4. After potting and removing entrapped air, the complete unit is ready for cure.

After 24 hours at room temperature (25°C) RTV-616 will cure sufficiently to be handled. Seven days cure at room temperature is necessary, however, to obtain optimum properties.

For production line use, the cure time can be substantially reduced by heating the compound.

Suggested cure times are:

65°C for 4 hours.
or 100°C for 1 hour.
or 150°C for 15-30 minutes.

For heavy parts the time required to bring the assembly up to curing temperature should be taken into account.

Pot life of catalyzed RTV-616 is four hours or longer at 25°C. Pot life may be extended by refrigeration.

Pot life is here defined as the length of time between catalyst addition and cessation of easy pourability.

COMPATIBILITY

RTV-615 and RTV-616 will cure in contact with a wide variety of the materials used in electronic assemblies. Certain materials, however, will cause inhibition of cure. Butyl and chlorinated rubber, sulfur containing materials, amines, and metal soap cured RTV's can cause inhibition of cure.

BONDING

With the use of primer SS-4120, RTV-615 or RTV-616 can be bonded to various materials used in electronic assemblies, including metals, most plastics, and glass. The surface to be bonded must be clean and dry. If parts to be potted are suitable for solvent cleaning, a trichloroethylene wash is suggested. Surface roughening will improve the bond to metals.

The primer is applied by brushing, spraying or dipping. Film thickness should be between 0.1 and 0.3 mils, typical of that obtained with one dip, or a single brushing. Films thicker than about 0.5 mils show poorer bonding properties.

The primer should be allowed to air dry for one hour before the compound is applied.

RELEASING RTV-615 OR RTV-616 FROM MOLDS

Where RTV-615 and RTV-616 are cured in molds, the use of a mold release is suggested to prevent the part from sticking. A 5% concentration of a household detergent such as Dreft in water has proved satisfactory for this use.

STORAGE AND HANDLING PRECAUTIONS

RTV-615 and RTV-616

Neither the compound or the curing agent is known to produce any toxic effect upon contact with the skin. These materials should be stored in clean, tightly closed containers in a cool, dry place.

RTV-615B and RTV-616B can generate flammable gas on contact with acidic, basic, or oxidizing materials, and such contact should be avoided.

PRIMER SS-4120

Primer SS-4120 is supplied in a methanol solvent. Methanol is flammable and poisonous. Keep SS-4120 away from heat, sparks and open flame. Keep container closed, use only with adequate ventilation and avoid breathing of vapor.

The properties shown in this data book have been determined from laboratory tests and are typical of the products. However, a reasonable degree of variation will occur in commercially produced material. The typical values shown here should not be used as a basis for specifications. For assistance and recommendations in the preparation of specifications, please contact the Silicone Products Department at Waterford, New York. (Publication Guides CDS-372, 373, 531 are available upon request.)

Standard test procedures developed for the rubber industry are frequently used in measuring silicone elastomers. The following standard tests have been used in obtaining test data shown here:

	ASTM	or	FSTM
Specific Gravity	D-792, Method A		601-14011
Durometer, Hardness, Shore A	D-676		601-3021
Tensile Strength and Elongation	D-412, Die "C"		601-4111, Die III
Tear Resistance	D-624, Die "B"		601-4211, Die II
Oven Aging	D-573		601-7221
Low Temperature Resistance	D-746		601-5311
Viscosity	D-1084, Method A		-------
Dielectric Constant and Dissipation Factor	D-150		406-4021
Dielectric Strength	D-149		406-4031
Volume Resistivity	D-257		406-4041

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SILICONES

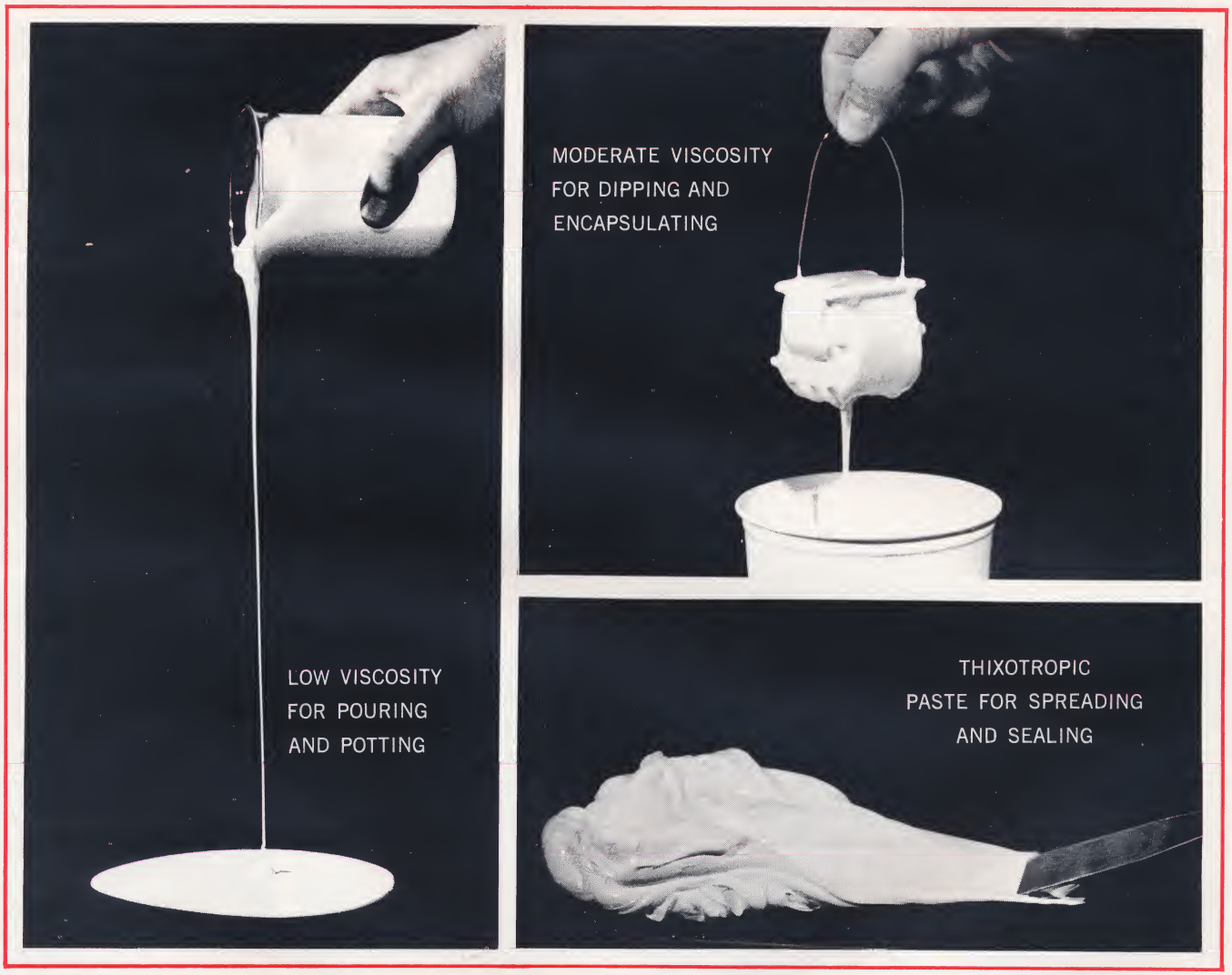
SUPPLEMENTARY DATA

S-3C-1B

FILE WITH
DATA BOOK
S-3C

SILICONE RUBBER RTV COMPOUNDS

for MIL-S-23586 (Wep)



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a complete line of RTV silicone rubber compounds designed to meet MIL-S-23586 (Wep)

SPECIFICATION INFORMATION MIL-S-23586 (Wep)

This military specification covers the requirements for room temperature vulcanizing (RTV) silicone rubber compounds most useful to aircraft and weapons applications. The specification describes the product and performance requirements of RTV silicone rubber compounds for electrical and mechanical applications as materials for potting, encapsulation, sealing and bonding.

PRODUCT SELECTION

General Electric offers a complete range of two-part RTV silicone rubber compounds designed to meet military specification MIL-S-23586 (Wep). Developed with the needs of the user in mind, these new materials make available to industry the broadest selection of qualified RTV silicone rubber compounds specifically designed to meet this specification.

The RTV-8000 series materials listed below provide by product designation a kit containing the RTV compound with the proper amount and type of curing agent.

DESCRIPTION	PRODUCT	CURE
Low Viscosity	**RTV-8111**	Fast Cure— Reversion Resistant
	RTV-8112	Medium Cure
	RTV-8113	Slow Cure
Moderate Viscosity	**RTV-8223**	Slow Cure
	RTV-8243	Slow Cure
	RTV-8262	Medium Cure
	RTV-8263	Slow Cure
Thixotropic Paste	**RTV-8372**	Medium Cure
	RTV-8373	Slow Cure
	RTV-8382	Medium Cure
	RTV-8383	Slow Cure

selector guide

Typical Properties — These General Electric two-part RTV compounds tested to MIL-S-23586 have been especially developed to provide the widest selection of viscosities, cure rates and handling properties to meet every application and processing requirement. The products are well suited for all types of industrial applications.

This chart gives typical properties only and is not intended for use in preparing specifications. See certification table.

PRODUCTS DESCRIPTION	RTV-8111	RTV-8112	RTV-8113	RTV-8223	RTV-8243	RTV-8262	RTV-8263	RTV-8372	RTV-8373	RTV-8382	RTV-8383
Viscosity	Low	Low	Low	Moderate	Moderate	Moderate	Moderate	Paste	Paste	Paste	Paste
Cure	Fast	Medium	Slow	Slow	Slow	Medium	Slow	Medium	Slow	Medium	Slow
MIL-S-23586 Classification											
Type	I	I	I	II	II	II	II	III	III	III	III
Class	1	2	3	3	3	2	3	2	3	2	3
Grade	B	A	A	A	A	A	A	A	A	A	A
Typical Uncured Properties											
Color	White	White	White	Pink	White	Red	Red	White	White	Red	Red
Consistency	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Thixotropic Paste	Thixotropic Paste	Thixotropic Paste	Thixotropic Paste
Viscosity, Poises	120	120	120	250	400	500	500	6000	6000	6000	6000
Non-Volatiles, %	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.	98 Min.
Shelf Life, Months	6	6	6	6	6	6	6	6	6	6	6
Catalyzed Pot Life @ 77°F	15-45 Min	1-3 Hrs	3-7 Hrs	3-7 Hrs	3-7 Hrs	1-3 Hrs	3-7 Hrs	1-3 Hrs	3-7 Hrs	1-3 Hrs	3-7 Hrs
Curing Agent and	RTV-9891	RTV-9858	RTV-9858	RTV-9858	RTV-9858	RTV-9858	RTV-9858	RTV-9858	RTV-9858	RTV-9858	RTV-9858
Level, %	2-4	6-8	2-4	1-3	1-3	5-7	2-4	4-6	1-3	5-7	1-3
Typical Cured Properties											
Specific Gravity	1.18	1.18	1.18	1.31	1.31	1.47	1.47	1.33	1.33	1.48	1.48
Hardness, Shore A	45	45	45	50	50	60	60	50	50	65	65
Tensile Strength, psi	350	350	350	550	500	800	800	500	500	750	750
Elongation, %	180	180	180	180	200	130	130	220	220	110	110
Linear Shrinkage, %	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6	0.2-0.6
Typical Electrical Properties											
Dielectric Strength, Volts/Mil	500	500	500	500	500	500	500	475	475	480	480
Dielectric Constant @ 10^3 Cps	3.6	3.6	3.6	3.4	3.6	3.7	3.7	4.0	4.0	4.0	4.0
Dissipation Factor @ 10^3 Cps	.019	.019	.019	.01	.01	.02	.02	.018	.018	.02	.02
Volume Resistivity, ohm-cm	$6x10^{14}$	$6x10^{14}$	$6x10^{14}$	$1x10^{14}$	$1x10^{14}$	$1x10^{14}$	$1x10^{14}$	$1x10^{15}$	$1x10^{15}$	$1x10^{14}$	$1x10^{14}$

GENERAL APPLICATION AND HANDLING SUGGESTIONS

Mixing

Thoroughly mix the base compound with the specified type and amount of curing agent. Should air entrapment result deaeration is recommended for the liquid materials. When thoroughly mixed apply and allow to cure. Typical 24 hour cure time is sufficient for product handling. MIL-S-23586 specifies a 72 hour cure time prior to final product evaluation or testing.

Curing Agents *

Curing agents RTV-9858 and RTV-9891 have as the active catalyst a liquid metal soap mixed with a suitable silicone base material and inert filler. The result is a curing agent with a pourable paste consistency.

Typical properties of curing agents

Characteristic	RTV-9858	RTV-9891
Color	Off-white — Beige	Light Blue
Consistency	Pourable paste	Pourable paste
Viscosity, Poises	200-600	200-800
Specific Gravity	1.58	1.75
Active Catalyst	Dibutyl Tin Dilaurate	Stannous Octoate

These curing agents contain organotin compounds as the active catalyst. Avoid prolonged skin contact which could result in skin irritation. In case of contact wash thoroughly with soap and water. In case of contact with the eyes, irrigate with water immediately and get medical attention.

Cure Rate and Pot Life

The pot life and cure rate of the 8000 series compounds shown in the property tables have been based on using the suggested amount of curing agent and a cure at room temperature. *Adjustments may be made in the curing agent level to obtain slight variation in both pot life and cure rate.* This involves increasing the curing agent level to speed the cure resulting in a corresponding reduction in pot life.

Pot life and cure rate can be changed by temperature also. Pot life may be extended by refrigerating the catalyzed compound. Cure rate in turn may be speeded up by curing at higher temperatures.

Bonding

All of the RTV compounds described in this data book can be bonded to most metals, plastics, glass, etc. by using a suitable primer. When properly applied, this will result in bonds stronger than the rubber itself.

Primers

For qualification to the adhesion requirements of MIL-S-23586 General Electric SS-4004 silicone primer was used. Other suitable primers are SS-4044 and SS-4101.

The bright, fluorescent pink color of SS-4004 makes it easy to determine whether a uniform coating has been applied. Fast drying solvents (acetone and isopropanol) in SS-4004 speed up its drying time, but these solvents are highly flammable and precautions must be taken to keep the primer away from fire or flame. The low flash point of SS-4004 prevents its being shipped by parcel post, except in sample quantities.

SS-4044 Clear Primer is a clear, colorless primer identical to SS-4004 except for the absence of the red color. The same solvents are employed and the same flammability precautions apply.

SS-4101 Primer is blue in color, available in handy aerosol cans for easy spray application as well as in bulk form for dipping or brushing.

Typical properties of RTV Silicone Primers

Property	SS-4004	SS-4044	SS-4101
Color	Fluorescent Pink	Clear	Blue
Solids, % (45 min. @ 150 C)	15-18	15-18	15-18
Specific Gravity (25/4 C)	0.84-0.86	0.84-0.86	0.92-0.96
Dry Time, hrs.	<1	<1	1 (approx.)

Bonding Procedure

All surfaces to be bonded should be thoroughly cleaned with a suitable solvent such as toluene, xylene, etc. Roughing up the surface with emery paper or sandblasting is not necessary.

SS-4004 or SS-4044 Primers are best applied by brushing or dipping. SS-4101 Primer may be brushed, dipped or sprayed — the spraying may be done by any convenient method, including the handy available aerosol cans. A uniform primer coat of approximately 0.5 to 1 mil in thickness usually provides the strongest bonds. When SS-4004 is used, the surface should be uniformly colored a light pink— *a dark red-pink color indicates too much primer; a light, almost colorless pink may indicate incomplete coverage.* The proper primer thickness, as indicated by color of the applied SS-4004 or SS-4101 Primers, which will give the highest bond strength in a given application can easily be determined by trial and can then be reproduced in subsequent production operations.

Allow the primer to air dry for at least a half hour (an hour is better) before the RTV is applied. On porous surfaces a second coat of primer may be required; allow at least an hour drying time between coats.

Apply the RTV compound by laying it in place on the primed surface without severe rubbing which might disrupt the primer coating.

Bonding to cured silicone rubber surfaces (RTV or heat cured) generally does not require the use of a primer.

(Continued on Back Cover)

*** To assure satisfactory results, be sure to stir catalyst well before addition to base compound.**

a new addition to G.E.'s line of proven RTV compounds

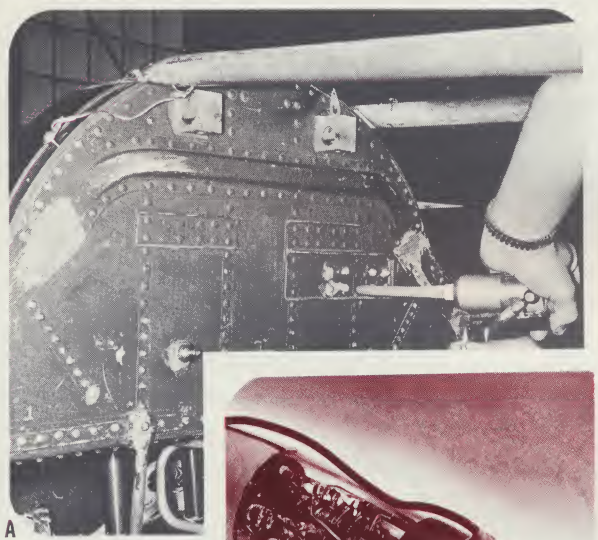
GENERAL PRODUCT INFORMATION

Only one elastomeric material has proved to be virtually immune to ozone, ultraviolet light, severe temperature change and oxidation through years of rough service. That material is silicone rubber. Originally developed by General Electric Research Laboratories silicone rubber has solved many design and engineering problems in both industrial and aerospace applications. The RTV-8000 series materials are a new addition to this line of proven RTV silicone rubber compounds. They were designed specifically to meet the performance and reliability standards established by MIL-S-23586 (Wep) and as other GE RTV Silicone Rubber Compounds, these new products provide:

- **RESISTANCE TO TEMPERATURE EXTREMES** —Retains elastomeric properties from −90°F to +600°F temperature range.
- **GOOD PHYSICAL AND ELECTRICAL PROPERTIES** Physical toughness and insulating ability are maintained over a wide range of operating temperatures.
- **RESISTS OZONE, WEATHERING AND AGING** — RTV silicone rubber resists the effects of aging and environmental conditions that break down ordinary elastomers.
- **CHEMICAL RESISTANCE** — RTV resists attack from many common oils, solvents and chemicals.
- **GOOD BONDING ABILITY** — Adhesion to properly primed surfaces is stronger than the rubber itself.

In addition the RTV-8000 series specifically provides:

- **EASY TO MIX CATALYST TO COMPOUND RATIOS** Convenient kit containing proper catalyst simplifies mixing.
- **PREVENTS COPPER CORROSION** — This system provides inhibition to copper corrosion, most important in electronic applications.
- **REVERSION RESISTANT CHARACTERISTICS** — RTV-8111 cures in deep sections and conforms to the reversion resistant requirements of MIL-S-23586 (Wep).



A

B

C

available in a range of viscosities for a variety of applications

A The thixotropic compounds which flow easily under pressure — yet do not sag or flow in place — were developed specifically for meeting stringent sealing and caulking requirements.

B RTV compounds are 100% solids and thus do not shrink significantly on curing. When using moderate viscosity compounds for encapsulation, voids and stress on components are eliminated. Silicone rubber won't transmit shock and vibration as inflexible encapsulants do.

C Low viscosity RTV compounds are used to pot electrical components to provide environmental protection and reliable performance under adverse operating conditions. RTV compounds cure at room temperature without generating heat.

SILICONES

supplementary data

RTV-340

LOW MODULUS RTV SILICONE RUBBER COMPOUND

DESCRIPTION

White medium viscosity room temperature curing silicone rubber compound having low modulus properties which include excellent high elongation, high peel strength, low durometer, and improved resistance to tear.

APPLICATIONS

RTV-340 offers improved rubber performance in the following application areas:

1. Preparation of excellent flexible molds, particularly those for highly intricate patterns with extreme draws and deep undercuts.
2. Sealant against gases, liquid, and dirt where high elongation and high peel strength are needed in addition to broad temperature range and age resistance requirements.
3. Excellent for use in absorbing mechanical shock and vibration because of its low durometer and may also be used to replace sponge in some applications.
4. Electrical potting, encapsulation, and impregnation for electrical and environmental insulation.

TYPICAL PRODUCT PROPERTIES AND DATA

(These values are not to be used for preparing specifications)

A. Uncatalyzed Base Compound

Color	- White
Viscosity Range	- 25,000-65,000 cps at 25°C(1)
Consistency	- Pourable liquid
Specific Gravity	- 1.15
Non-volatile content, % min. (24 hrs. at 158°F)	- 98
Lbs. per Gallon	- 9.6

B. Catalyzed Compound

Compound catalyzed by 5% or 10% by weight of Special paste catalyst RTV-9891. Liquid catalyst RTV-9801 may also be used. (Ref. Section IV Handling)

(1) Measured with Brookfield RVF Viscometer, #6 Spindle at 10 rpm. Sample stirred before taking reading.

	RTV-340/catalyst at 0.5 wt % RTV-9801	RTV-340/catalyst at 10 wt % RTV-9891
Initial Application Rate, g/min.(2)	400	700
Application Rate, g/min.(2) (1/2 hr. after catalyzation)	100-125	200
Application Rate, g/min.(2) (1 hr. after catalyzation)	25-50	25-40
Work Time, hours	1-2	1-2
Tack Free Time, hours	3-4	3-4
Hardness, Shore A 48 hours	15-20	15-20
Weight Loss on Cure, % (at 77°F)		
48 hours	0.06	0.06
1 week	0.09	0.09

C. Cured Compound

1. Physical Properties– cold pressed ASTM sheets cured 48 hrs/77°F

Catalyst	0.5 wt % RTV-9801	10 wt % RTV-9891
Specific Gravity	1.15	1.15
Hardness, Shore A	15-20	15-20
Tensile Strength, psi	200	210
Elongation, %	300	300
Tear Resistance, Die B, lb/in.	>40	>40
Bashore Resilience, %	60	60
Brittle Point, ASTM D-746	Below -100°F	Below -100°F
Peel Strength, lb/in. (bonded to Alclad Aluminum, SS-4004 primed, 10-20 mesh Aluminum Screen used)	12	12

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2. Physical Properties – Heat Age

ASTM sheets prepared as above and heat aged in circulating air oven

	24 hrs/ 300°F	24 hrs/ 400°F	24 hrs/ 480°F
Hardness, Shore A	24	25	25
Tensile Strength, psi	280	285	285
Elongation, %	425	400	235

(2) Application Rate tested by placing catalyzed compound in Semco Sealing gun cartridge with a Semco 440 nozzle with orifice diameter 0.125 ± 0.005 inch attached. A constant air-pressure supply of 90 ± 2 lb/in.^{2} was connected to the gun.

3. Electrical Properties

ASTM sheets prepared as above, plus 24 hours at 23°C (75°F) and 50% RH prior to testing for electrical characteristics.

Dielectric Strength Volts/mil. (60 mil. sheet)	580
Dielectric Constant	
60 cps	2.75
10^3 cps	2.61
10^6 cps	2.50
Dissipation Factor	
60 cps	.0098
10^3 cps	.007
10^6 cps	.004
Volume Resistivity Ohm – cm.	2×10^{14}

SUGGESTIONS FOR HANDLING

A. Mixing and Curing

RTV-340 must be cured with either special paste catalyst RTV-9891 or liquid RTV-9801. When using RTV-9891, a 10% by wt. addition is recommended and should give the best cured rubber properties; however, catalyst and concentration may be varied to suit specific applications.

Liquid catalyst RTV-9801 is recommended when working with smaller amounts of RTV-340. Catalyst concentrations of 0.5 to 1.0 wt. %(drops addition to grams of compound) provide cure characteristics and final rubber properties as described by RTV-9891 paste system at the 5% and 10% ratios respectively.

In order to obtain a uniformly cured rubber, it is necessary to mix the curing catalyst thoroughly into the compound. Mixing should be performed in such a manner that a minimum amount of air is entrapped in the compound to eliminate voids. A vacuum treatment may be used to remove air bubbles.

NOTE: 1. This compound-catalyst system cures best under low humidity conditions and in closed molds. High humidity conditions at the time of cure may produce a slightly tacky surface. This tack will disappear in several days. The rubber may be dusted with a talc if it remains a problem. Higher catalyst levels will eliminate this tack condition.

2. Adjusting the ratio of compound to catalyst will provide a variation in work life and cure time characteristics.

B. Thick Section Cure

Excellent thick section cures in closed molds can be achieved by catalyzing RTV-340 with special paste catalyst RTV-9891 or liquid RTV-9801. The aid of heat or exposure of compound to air is not required; however, if faster cure is desired, the part may be heated to 150°F for several hours.

If thick sections of the product are to be used in service over 300°F, the cured product should be temperature conditioned prior to service. A suggested program is four to eight hours at 50°F intervals from 200°F to service temperature. Longer times at each temperature may be required for larger parts.

C. Storage and Shelf Life

RTV-340 should be kept in clean, tightly sealed containers when not in use. Compound should be stirred before using. The useful shelf life is in excess of four months. Refrigeration below 40°F will increase shelf life.

REQUIRED CATALYSTS

RTV-9801 (liquid) and RTV-9891 (paste) are special catalysts required to provide the excellent closed mold-thick section curing characteristics in RTV-340.

Typical Properties

Characteristics	RTV-9801	RTV-9891
Color	clear-light straw	light blue
Consistency	liquid	pourable paste
Viscosity	-	(500 to 850 poises)
Specific Gravity	1.26	1.75

BONDING

RTV-340 will bond to other surfaces by techniques described on page 11 of Technical Data Book S-3C, available upon request. Bond strengths are greater than the rubber itself. Recommended primers are SS4004, SS4044 and SS4101.

ORDERING INSTRUCTIONS

Specify quantity and product and catalyst designation as indicated. Orders should be sent directly to General Electric Company, Silicone Products Department, Waterford, New York or to the Silicone Products Department sales office nearest you.

RTV-7 SILICONE RUBBER FOAM

General Electric RTV-7 Foam is a low density silicone sponge rubber which expands and vulcanizes at room temperature. Thorough mixing of the curing agent with the base compound initiates the chemical action. Within 10 minutes foaming and curing are complete and the cured foam may be handled. Like other silicone rubber materials, RTV Foam maintains its flexibility over a wide temperature range. It also has excellent electrical properties and good resistance to many chemical reagents.

Manufacturer's Specifications

Uncatalyzed Base Compound

Viscosity, Cps at 77 F	7000-9000
Color	Black
Specific Gravity	1.11 ± .02
Shelf Life	3 Months

Cured RTV-7 Foam (5 Wt. % Stannous Octoate) 77F and 50 Percent RH

RTV Tack Free Time, Minutes	5 ± 2
Density, Max.	12.5 lb/ft^3

Some settling of the base compound normally occurs upon standing. To obtain uniform properties, thorough mixing should precede use.

Typical Properties of RTV-7 Foam

(These values are not for use in preparing product specifications)

CURED RTV FOAM

(100 parts of RTV-7 Foam mixed with five parts of catalyst. Samples cured 24 hours at 77 F and 50 percent RH.)

Density

Free Blown	= 12.5 lbs/ft^3
0.125 Inch Molded Slab	= 16.7 lbs/ft^3
*Tensile Strength	= 20 psi
*Elongation	= 70%

*Measured on ASTM dumbbells cut from an 0.080 inch thick molded slab.

Compression Set – (Molded sheets cured 48 hours at 77 F/50% RH.)

25% Compression for 22 Hrs/212 F = 12%
50% Compression for 22 Hrs/212 F = 9%
**50% Compression for 22 Hrs/212 F = 5%

**(This sample given oven post cure of 1 hr/212 F before compression.)

Compression Deflection – (Cured 48 hours at 77 F/50% RH.)

0.125 inch molded slab.
10% Deflection = 0.5 psi load
25% Deflection = 1.0 psi load
50% Deflection = 2.8 psi load

Typical Electrical Properties – (Measured on 0.050 inch thick molded slab.)

Dielectric Strength	147 volts/mil
Dielectric Constant, 10^2-10^5 cps	1.8
Volume Resistivity	6.6 X 10^{15} ohm-cm

BLENDING

RTV-7 Foam is compatible with most General Electric RTV products. Variations in properties to fit a specific need may be obtained by adding up to 20 weight percent of another RTV silicone rubber compound to RTV-7 before catalyzation.

Typical Compression Deflection and Density Data – (as determined on the following RTV blend formulations)

RTV Blend Formulation	Sample Thickness	Compression Deflection 10%	25%	Lbs/In 50%	Density Lbs/Ft^3
RTV-7	0.125"	0.5	1.0	2.9	16.7
RTV-7 (100 Parts) + RTV-11 (25 Parts)	0.125"	0.8	1.9	5.3	19.4
RTV-7 (100 Parts) + RTV-60 (25 Parts)	0.125"	0.8	1.7	5.7	21.2
RTV-7 (100 Parts) + RTV-90 (25 Parts)	0.125"	1.1	2.2	8.3	24.8

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CATALYZATION

After mixing the base compound to uniformity, add five to eight weight percent curing agent. Stir vigorously for about 30 seconds. (RTV Foam may be stirred by hand or with mixing equipment specially designed for production line use.) The catalyzed compound begins to foam and cure as soon as mixing is begun and should be poured within 60 seconds from the start to mixing. Expansion and cure are complete within three to four minutes and the foam may be handled within 10 minutes. The time between mixing and cure may be extended by cooling the base compound before catalyzing. Variations of curing agent concentrations, between four and six weight percent, also provide further control of application time.

Caution

1. RTV Foam is expanded via the evolution of hydrogen gas. The necessary precautions should be taken while the material is foaming.
2. The curing agent contains stannous octoate which is known to irritate the eyes. Should some catalyst enter the eye, it should be flushed with large amounts of water and proper medical attention should be obtained.
3. The curing agent is degraded upon exposure to air and moisture. When not in use the container should be kept tightly sealed.

APPLICATIONS/TECHNIQUES

RTV-7 low density silicone rubber foam is used for applications requiring:

1. Mechanical shock and vibration damping.
2. Cast in place thermal insulation.
3. Fabricated/Molded foamed rubber parts.
4. Light-weight electrical insulation.

Molding/Release

When foamed silicone rubber parts are desired, the use of a mold release is suggested for handling ease. Standard polytetrafluoroethylene sprays have been found to give optimum performance. Mold cavities are coated with this release agent before the catalyzed RTV Foam is poured into the molds.

Adhesion

Excellent adhesion of RTV-7 Foam to most substrates is obtained using standard G-E silicone primers such as SS-4004. Substrates to be bonded should be thoroughly cleaned followed by a brush coating of the primer and a usual one hour air dry. The RTV-7 may then be applied and allowed to cure. Foamed RTV-7 will achieve bond strengths exceeding the cohesive strength of the elastomer.

HANDLING AND STORAGE

The catalytic action of RTV-7 is such that it generates flammable gas on contact with acidic, basic, or oxidizing materials. Store in original containers with top up, in a cool place. The room temperature shelf life of this product is in excess of three months from date of shipment. Refrigeration at +40 F will increase shelf life. DO NOT FREEZE.

ORDERING INSTRUCTIONS

Specify quantity and product designation as indicated. Orders should be sent directly to General Electric Company, Silicone Products Dept., Waterford, N. Y., or to the Silicone Products Department sales office nearest you.